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The Use of Vocational Interest Scales in Planning a Medical Career¹

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CHAPTER I

THE PROBLEM

A. TRAINING MEDICAL SPECIALISTS

ABOUT two hundred graduates of medical schools enter the Army each year for internship training. Many of these interns later receive Regular Army commissions and take residency training in one of the medical specialties. A substantial number of Medical Corps officers have been certified by an American Board as diplomates in some specialty.

It is desirable that the Army should train the best two hundred of the approximately one thousand applicants—"best" meaning those who will profit most from further training and continue to serve satisfactorily in the Army. It is also desirable that these doctors shall be assigned to the type of training and work for which they are best fitted and in which they are most interested.

The research contract between the Surgeon General, U.S. Army, and Stanford University specified the "development of improved methods of guiding Army Medical Corps officers into specialty training. Emphasis will be placed on the development of measures of interest, motivation, and other personal factors, rather than on aptitudes or abilities." As it was not known whether medical specialists could be separated in this way, the project was restricted to the differentiation of four specialist groups, namely, internists, surgeons, pathologists, and psychiatrists. If such differentiation proved successful, further research was contemplated to differentiate other specialty groups.

Emphasis was placed on the development of measures of interest as indicative of what a person wants to do and will continue to enjoy doing. Research is

being conducted under other auspices relative to aptitudes and abilities which indicate what a person is capable of doing. For example, the Association of American Medical Colleges and the Educational Testing Service are working on improving the methods of admission to medical school.

This project was conceived primarily from a guidance, not a selection, point of view. The Career Guidance Section of the Surgeon General's Office is continuously seeking better ways to carry out its functions. It was recognized that any improved methods developed for guiding Army Medical Corps officers into specialty training would be equally useful to young civilian doctors planning their professional careers. The methods developed by this research, therefore, are being made available to the medical profession.

B. APTITUDES AND ABILITIES VERSUS INTERESTS

In selection and guidance what a person *can* do is important. But what a person *wants* to do is equally important and far too often ignored. For example, men differ from women very little in intellectual capacities but they employ their abilities in different ways because they have different objectives in life—their interests are different. Graduate students in medicine differ very little in general intelligence and scholastic achievement from graduate students in business administration, but they have chosen entirely different careers. Table 1 consists of the distributions of scores of physicians, medical school seniors, and graduate students in business administration

TABLE 1
PERCENTAGE OBTAINING EACH RATING ON
THE PHYSICIAN INTEREST SCALE

Rating	Score	Prac- ticing Physi- cians	Seniors in Medical School	Graduate Students in Business Admin- istration
A	45-70	71	73	1
B+	40-44	13	14	2
B	35-39	8	8	4
B-	30-34	5	4	10
C	0-29	3	1	83
	Total	100%	100%	100%

on the Physician Scale of the Vocational Interest Blank. The differences in their choices are most clearly indicated in their scores on the interest blank. Whereas 73 per cent of the medical students had an A rating, only 1 per cent of the business students had such a rating. The mean scores are, respectively, 51 and 22.

The Physician Interest Scale is based on the responses of 500 physicians representative of all physicians in the United States. When a man takes this test, his responses are compared item by item with the typical responses of physicians; his score expresses how well his interests agree with those of physicians in general.

C. HOW PERMANENT ARE INTERESTS?

Does a man possess the same interests in later life that he had when he was a student? We are not here concerned with interest in some specific activity such as dancing or chess. We know that such interests are not particularly permanent. We are concerned with broad summaries of many specific interests, such as scientific, linguistic, and musical interests. Such interests are surprisingly permanent.

The permanence of scores on the original Physician Scale is given in Table 2 for intervals of one to twenty-two years.

These data indicate that the physician interest score of a college man is likely to agree fairly closely with the scores he will obtain many years later.

When a college man is attempting to decide his future career, he is scored not on the Physician Scale alone, but on many other occupational scales. His choice should be made from those occupations on which he has the highest

TABLE 2
PERMANENCE OF SCORES ON ORIGINAL
PHYSICIAN INTEREST SCALE

Subject	Dates Tested	Interval in Years Between Test and Retest	Median Cor- relation
College Freshmen	1930-31	1	.85
College Seniors	1927-32	5	.78
College Seniors	1927-37	10	.77
College Freshmen	1930-49	19	.62
College Seniors	1927-49	22	.64

scores. The data in Table 3 indicate that a profile of 34 interest scores will agree very closely with a second profile secured up to 22 years later. From a guidance point of view the data in this table are more significant than those in Table 2 as they warrant the expectancy that the relative standing of occupational interest scores will be remarkably stable.

TABLE 3
PERMANENCE OF PROFILES OF INTEREST
SCORES (7)

Subjects	Dates Tested	Interval in Years Between Test and Retest	Median Cor- relation
College Freshmen	1930-31	1	.88
College Seniors	1927-32	5	.84
College Freshmen	1930-39	9	.67
College Seniors	1927-37	10	.82
College Freshmen	1930-49	19	.72
College Seniors	1927-49	22	.76

D. WILL INTEREST SCORES PREDICT BEHAVIOR?

Reliability and permanence of test scores are important. But the most important measure of a test is the extent to which it predicts future behavior. Do college men who score high on the Physician Scale actually become physicians and do those who score low enter occupations other than medicine?

Among 670 Stanford University freshmen of 1930 and seniors and graduate

sponsibilities are considered, it is amazing that any test could predict entry into medicine to the extent shown.

Our data actually show a still better relationship than that indicated above between interest scores in college and occupation engaged in 20 years later. Men with relatively high physician scores, who did not actually enter medicine, definitely did tend to enter occupations closely related to medicine, such as dentistry, biological sciences, etc.

The Physician Scale is designed to predict the probability that a person would like or enjoy the practice of medicine. Since *practicing* medicine is somewhat different from *studying* medicine, there are men who like one but not the other. Several outstanding students in law school have had low lawyer-interest scores. Later on they entered other occupations, well foretold by their low lawyer scores. Because they were good students, they had enjoyed studying law but they discovered later on that they did not like the activities common to legal practice. A medical student with a low physician interest score may enjoy medical school; but he will probably not enjoy medical practice.

TABLE 4

COMPARISON OF PHYSICIAN INTEREST SCORES OF COLLEGE STUDENTS WHO BECAME PHYSICIANS WITH THOSE WHO DID NOT (8)

Physician Interest Rating	Students Who Became				Chances in 100 of Be- coming a Physi- cian
	Physicians		Non- Physicians		
	Num- ber	Per Cent	Num- ber	Per Cent	
A	70	65%	63	11%	53
B+	14	13%	56	10%	20
B	10	9%	73	13%	12
B-	9	8%	73	13%	11
C	5	5%	297	53%	2
Total	108	100%	562	100%	

students of 1927, whose occupational careers are known up to 1949, 108 became physicians and 562 did not. The distributions of their physician interest scores are given in Table 4. The mean physician interest score of those who became physicians is 47; the mean score of those who did not is 30, a very large difference. Among these 670 students there was a 53 per cent chance of becoming a physician with an A rating, 20 per cent with a B+ rating, 12 per cent with a B rating, 11 per cent with a B- rating, and only 2 per cent chance with a C rating. When all the extraneous factors such as ability, health, financial status, and family re-

E. QUESTIONS REGARDING A MEDICAL CAREER

A guidance point of view implies an orientation in terms of the decisions to be made by a young man who is interested in medicine. There are four questions he must answer successively, namely:

- Should I be a physician?
- If so, should I specialize?
- If so, what specialty?
- What about other activities within the medical profession?

a. Should I Be a Physician?

This question does not merely mean, Does he have the characteristics of a physician? It must mean, Does he have the characteristics of a physician to a greater degree than he has the characteristics of an engineer, lawyer, accountant, and all the other occupations that college men are likely to enter? To answer this question, the college man should be scored on a battery of many occupational scales. He should seriously consider the pros and cons before entering an occupation on which he obtains a low score. Interest is not the only factor in vocational selection, but it is an important factor not lightly to be disregarded.

What is meant by the expression "characteristics of a physician"? The essence of being a physician consists primarily of those modes of behavior in which physicians differ from other men. The only men who should consider medicine as a career are college men or potential college men. We are concerned, therefore, with only the differences between physicians and men in the occupations that college men normally enter, not with all men in the United States. In developing a scale for physician interest, the likes and dislikes of physicians are contrasted with the corresponding responses of men in the occupations entered by the majority of college men. All items to which the two groups respond alike are ignored; the only items which are included in the scale are the items on which physicians differ from the men-in-general group.¹ A

¹ This men-in-general group is the same as the P₁ (point of reference group used by Strong for his regular vocational interest scales. Approximately 4500 blanks were used and these were selected to be representative of men in the occupations that college men normally enter (5, p. 711f).

score on the Physician Scale indicates whether a man differs from men in general in the same manner that physicians differ from men in general or whether he differs in some other direction.

b. Should I Specialize?

Specialization generally requires three years of residency training and study preparatory to passing an examination. It also requires the diplomate to restrict his activities to his own field. The medical student must decide whether he desires this or prefers to enter immediately into practice and to handle a wider range of cases. At present about 15 per cent of physicians are specialists certified by an American Board. It appears likely that this percentage will double in the next twenty years.

The essence of being a medical specialist consists in the differences in behavior between all medical specialists and all medical nonspecialists. The Specialization Level Scale is based on such groups and measures the differences in interests of specialists from physicians in general. About 30 per cent of physicians obtain an A rating on this scale. (See Technical Note C.)

c. If I Am To Specialize, Which Specialty Should I Select?

The four specialty scales for internist, surgeon, pathologist, and psychiatrist measure the extent to which the physician has the interests of men in each of these specialties as distinct from the interests of physicians in general.

It is expected that scales for other specialties will be developed. In the meantime scores on these scales will give some idea of how one would score on other specialties. For example, a medical student interested in orthopedic surgery

ought to score like a surgeon and not like a psychiatrist.

Only medical men should be scored on these specialty scales. The scales are so constructed that they presuppose that the men who are tested have the interests of a physician. No meaning can be attached to scores on these scales when the man does not have the interests of a physician.

d. What About Other Activities Within the Medical Profession?

Some men enjoy and seek administrative work, other men dislike such activities and avoid them. For example, Command and Staff medical officers score like public administrators, whereas typical medical practitioners score much lower on such interest scales. It may be expected that a young M.D. with a low

score on the Physician Scale and high scores on the Public Administrator and the Office Worker Scales will like administrative work. He will probably either seek such work or will gradually drift into it as time goes on. Similarly a physician with the interests of an aviator might enjoy the work of a flight surgeon.

Other occupational interest scores should be helpful in planning a medical career which includes activities not involving the actual treatment of patients.

The reader interested only in the general results of this project and how these results can be used by an individual might omit Chapters II and III, reading Chapter IV next. Those interested in the procedures employed in this research should read Chapters II and III next.

CHAPTER II

THE DEVELOPMENT OF THE INTEREST SCALES

A. THE PRIMARY PROBLEM

THE primary problem of this research is the differentiation of the medical specialists, i.e., to try to answer the question, "What specialty?" It is evident that the question, "Should I specialize?" should be answered before considering a particular specialty.

Differentiation has reference to differences, not similarities. The essence of being a physician consists in having those characteristics of physicians not found in other men. Physicians possess interests, objectives, goals not common to other men; they have certain skills which others do not have, etc. The sum total of all these differentiating characteristics is what is meant by being a physician. Differentiation is discussed more fully in Technical Note A.

Differentiation of the medical specialists consists of measuring the differences among the several groups of specialists and between specialists and the average physician. We are not considering differences in abilities or aptitudes but, rather, differences in interests and preferences. It is believed that such differences will predict continuing to like the activities of a particular specialty.

This study is restricted to the four specialties of Internal Medicine, Surgery, Pathology, and Psychiatry. The devices used were the Strong Vocational Interest Blank for Men and the Medical Specialists Preference Blank, the latter blank having been specifically developed for this purpose. Briefly, the procedure was to administer these blanks to groups of specialists and to reference populations of men in general and physicians in general. Several kinds of interest scales were

then constructed on the basis of differences in proportions of the various groups responding to the different items on the blanks. These scales were then administered to determine their effectiveness in differentiating the several groups.

B. CRITERION AND REFERENCE GROUPS

In this research a surgeon, for example, is defined as a diplomate of the American Board of Surgery. Although it would not be claimed that all doctors practicing surgery are diplomates of the American Board of Surgery, it would generally be conceded that all such diplomates are surgeons. Similarly, internists, pathologists, and psychiatrists were defined as diplomates of their respective American Boards.

In selecting the names for these four criterion groups from the Directory of Medical Specialists (1), the youngest were preferred. In the case of foreign-born doctors, only those receiving their medical education in this country were included. (See Table 5.)

In order to determine how the interests of specialists differ from those of the average physician, it was necessary to establish a group of physicians as a point of reference. The American Medical Association provided a list of 2500 names randomly selected by machine records

TABLE 5
SIZE AND MAXIMUM AGE OF CRITERION
GROUPS OF SPECIALISTS

	Intern- ists	Sur- geons	Pathol- ogists	Psychi- atrists
Number	1000	1000	600	1000
Year of Birth of the Oldest	1910	1907	1900	1905

TABLE 6
NUMBER OF BLANKS USED IN ITEM COUNTS

	Internists	Surgeons	Pathologists	Psychiatrists	Physicians in General
Vocational Interest Blank	400	400	300	400	500
Medical Specialists Preference Blank	300	300	200	300	400

from their list of all physicians in the United States. This physician-in-general reference group will be referred to as P_{med} (Point of reference—medical).

A large number of occupational interest scales have been developed in the past twenty-five years for the Vocational Interest Blank. Most of these scales were based on comparisons with a group of men in the occupations that college men tend to enter. This was considered the correct reference group since these scales were designed primarily for use by college men. This reference group of men in general was based on over 4500 blanks and will be referred to as P_{men} (Point of reference—men).

C. INTEREST AND PREFERENCE BLANKS

The Strong Vocational Interest Blank for Men consists of 400 items, such as occupations, school subjects, amusements, activities, and peculiarities of people. The person being tested responds by indicating whether he likes, dislikes, or is indifferent to each of the items. This blank has been widely used for many years and some fifty occupational scales have been constructed using the P_{men} reference group.

Since our primary objective is to differentiate among the medical specialists and between each specialty group and the average doctor, it was believed that a blank designed specifically for use by the medical profession might be particularly

effective. Various hunches or rationales prompted the development of the different types of items. It was postulated that there would be systematic differences among the four types of medical specialists regarding their preferences for type of professional associate, medical school subjects, casual acquaintances, and descriptions of occupational and recreational activities. Biographical items referring to family and personal background were included.

The Medical Specialists Preference Blank was assembled from items tried out with doctors at three Army hospitals. It consists of 171 items, more than half of which are of the forced-choice type which does not permit an "indifferent" response. The development of this blank is described in Technical Note E.

D. COLLECTION OF BASIC DATA

The Vocational Interest Blank was mailed to the four medical specialist groups in September 1949 and to the physicians-in-general group in May 1950. The Medical Specialists Preference Blank was mailed to these same groups in September 1950. The 3600 doctors in the four medical specialist groups returned 48 per cent of the Vocational Interest Blanks and 42 per cent of the Medical Specialists Preference Blanks.

The basic data required for the construction of interest scales are the percentages of each group marking the respective choices under each item. Item

¹ See footnote 1, Chapter I.

counts were made of responses to the Vocational Interest Blank and the Medical Specialists Preference Blank by each of the four medical specialty groups and by the physicians-in-general group. The number of blanks used in each group is shown in Table 6. Other blanks that were returned were used for cross validation as reported in Technical Note F.

E. THE INTEREST SCALES FOR MEDICAL SPECIALISTS

The methods used in developing the various scales as well as the technical problems involved are described in detail in Technical Note B. In this section only a brief summary will be given of these procedures.

In constructing scales to measure differences between two groups, each item is assigned a weight on the basis of the difference in the percentages of each group responding in a given way. For example, if a larger proportion of the surgeons than physicians in general like to play golf, then a response of "Like" to the item "golf" on the Vocational Interest Blank would be given a positive weight on the Surgeon Scale.

It is obvious that many different types of comparisons can be made, each of which could result in an interest scale. Scales based on different points of reference could be constructed for each of the specialist groups. Scales could use either the Vocational Interest Blank, or the Medical Specialists Preference Blank, or both blanks combined.

A Physician Scale using the Vocational Interest Blank and based on differences between a group of physicians and the men-in-general reference group has been available for many years. A revised Physician Scale using the P_{med} reference group as the criterion was one of the first

scales constructed on this project. An individual's score on this scale indicates whether his interests are more like those of physicians or more like those of men in occupations ordinarily entered by college men. This revised Physician Scale is described in Technical Note D and is based on a more recent and representative sample of physicians than was the original scale.

Using only the Vocational Interest Blank, scales were constructed for each of the four medical specialist groups based, first, on the P_{men} (men in general) reference group and, second, on the P_{med} (physicians in general) reference group. As had been expected, the intercorrelations among the four scales based on P_{men} (average $r = .86$) were much higher than among the four scales based on P_{med} (average $r = .28$). That is, when compared to men in general, internists, surgeons, pathologists, and psychiatrists are much more alike than when they are compared to physicians in general. These relationships indicated that only scales based on the physicians-in-general reference group should be used for differentiating medical specialists.

It was found that scales using *both* the Vocational Interest Blank and the Medical Specialists Preference Blank were superior to scales using either blank alone. Interest scales using both blanks and based on differences between each of the four medical specialist groups and the P_{med} (physicians in general) reference group were constructed. These scales differentiated very well between the specialist groups and the physicians in general (average $r_{bis} = .81$) and fairly well among the four specialist groups (average $r_{bis} = .67$).

The poorest differentiation was on the Internist Scale between internists and

pathologists ($r_{bis} = .43$) and between internists and psychiatrists ($r_{bis} = .23$). Are the interests of internists very similar to the interests of psychiatrists and pathologists, or is the relative failure to differentiate caused by faulty scales? In order to answer this question, scales were constructed based on direct comparisons of each of the six pairs of medical specialist groups. The results with these scales indicated that it should be possible to differentiate internists from pathologists and from psychiatrists almost as well as among the other specialist groups.

Several attempts were made to improve the differentiation between internists and psychiatrists and between internists and pathologists. As stated above, the four original medical specialist scales were based on differences between each specialist group and the physicians-in-general reference group. A procedure was developed for selecting those items on the original scales which met certain requirements with reference to discriminating among the four specialist groups. These selected-items scales were substantially better than the original scales in differentiating between internists and psychiatrists ($r_{bis} = .58$ vs. $.23$) and between internists and pathologists ($r_{bis} = .56$ vs. $.43$).

Unless otherwise indicated, the Internist, Surgeon, Pathologist, and Psychiatrist Scales referred to in this report are these selected-item scales using both the Vocational Interest Blank and the Medical Specialists Preference Blank.

One other scale has been developed. The interests of the internists, surgeons, pathologists, and psychiatrists, considered as a single group of specialists, are contrasted with the interests of the P_{med} (physicians in general) reference group. The resulting scale is called the Speciali-

zation Level Scale. Certain preliminary investigations suggest that scores on this scale may identify individuals who will enjoy taking further specialized training and narrowing the field of their professional work. The development of the Specialization Level Scale is described in Technical Note C.

F. INTERCORRELATIONS OF SCALES AND RELIABILITY

One measure of the goodness of interest scales for purposes of discrimination is based on the intercorrelations of such

TABLE 7
INTERCORRELATIONS OF MEDICAL SPECIALISTS
SCALES ($N=100$ PHYSICIANS IN GENERAL)

Scale Correlated	Original Scales	Selected-Item Scales
Internist vs. Surgeon	-.04	-.54
Internist vs. Pathologist	.64	.05
Internist vs. Psychiatrist	.72	.04
Surgeon vs. Pathologist	.11	-.17
Surgeon vs. Psychiatrist	-.20	-.46
Pathologist vs. Psychiatrist	.42	.05
Average	.27	-.17

scales. The lower the intercorrelations, the better the scales. A high positive correlation between two scales means a person obtaining a high score on one scale would tend to get a high score on the other scale. That is, scores of individuals on the two scales would tend to be equal. With a correlation of zero there would be no relationship between the scores of individuals on the two scales. A high negative correlation gives the best differentiation since individuals getting high scores on one scale tend to get low scores on the other.

Table 7 gives the intercorrelations of both the original scales and the selected-items scales. The improvement with the selected-item technique is apparent with

a reduction of the average intercorrelation coefficient from .27 to $-.17$. The Surgeon Scale correlates negatively with each of the other three and the other correlations approximate zero.

Estimates of the reliabilities of the scales were obtained by correlating scores on the odd-numbered items with scores on the even-numbered items and correcting by the Spearman-Brown formula.

The resulting reliability estimates for the scales on both blanks combined are: Internist Scale .69, Surgeon Scale .79, Pathologist Scale .89, Psychiatrist Scale .89, and Specialization Level Scale .79. These reliabilities are considered acceptable. The problem of reliability is discussed in more detail in Technical Note F.

CHAPTER III

DIFFERENTIATION OF GROUPS

A. STANDARD SCORES AND LETTER RATINGS

IN ORDER to make comparisons between different groups on the various interest scales, it is necessary to have common units of measurement. Standard scores were established for all scales by setting the mean of the criterion group equal to 50 and the standard deviation equal to 10. These standard scores on the different interest scales are thus directly comparable. Any score given in this report will be a standard score unless otherwise indicated.

Letter ratings from A to C have been used for twenty-five years to express occupational interest scores on the Vocational Interest Blank. An A rating corresponds to standard scores of 45 and above, a B+ rating to scores of 40-44, a B rating to 35-39, a B- to 30-34, and a C rating includes scores of 29 and below.

In explaining the meaning of the letter ratings it may be helpful to consider what proportion of the criterion group would obtain each rating. For example, it would be expected that the scores made by surgeons on the Surgeon Scale would be distributed approximately as follows: A 70%, B+ 15%, B 9%, B- 4%, and C 2%. Most of our criterion groups approximate this distribution quite closely.

Both standard scores and letter ratings will be used to describe the differences between the various groups. The use of interest scales for individual guidance will be discussed in Chapter IV of this report.

B. MEASURES OF OVERLAPPING AND CORRELATION

In comparing the distributions of in-

terest scores made by two groups, a measure of the overlapping has been found useful. Overlapping is defined as "the percentage of scores made by one group which could be matched with scores in the other group." Table 8 shows one way of estimating this overlapping and in-

TABLE 8
OVERLAP OF MEDICAL AND NONMEDICAL
STUDENTS ON THE PHYSICIAN
INTEREST SCALE

Rating	Per Cent of Seniors in Medical School	Per Cent of Non- medical College Students	Per Cent* of Overlap of Two Groups
A	73	11	11
B+	14	10	10
B	18	13	13
B-	4	13	4
C	1	53	1
Total	100%	100%	39%

* The smaller of the 2 per cents represents scores common to both groups and, hence, the overlap.

indicates that medical school seniors and nonmedical college students overlap on the Physicians Interest Scale about 39 per cent. A formula by Tilton (9) gives practically the same result and is easier to use. This formula was used in computing all the estimates of overlap in this report.

This example indicates that the percentage of overlapping can be considerable even with two groups that are quite sharply differentiated. It may be helpful to consider the overlap of other groups on other scales. Engineers overlap on the Engineer Scale with other occupational groups as follows: chemists 65%, physicians 42%, accountants 36%, and life insurance salesmen 10%. Accountants overlap on the Accountant Scale with

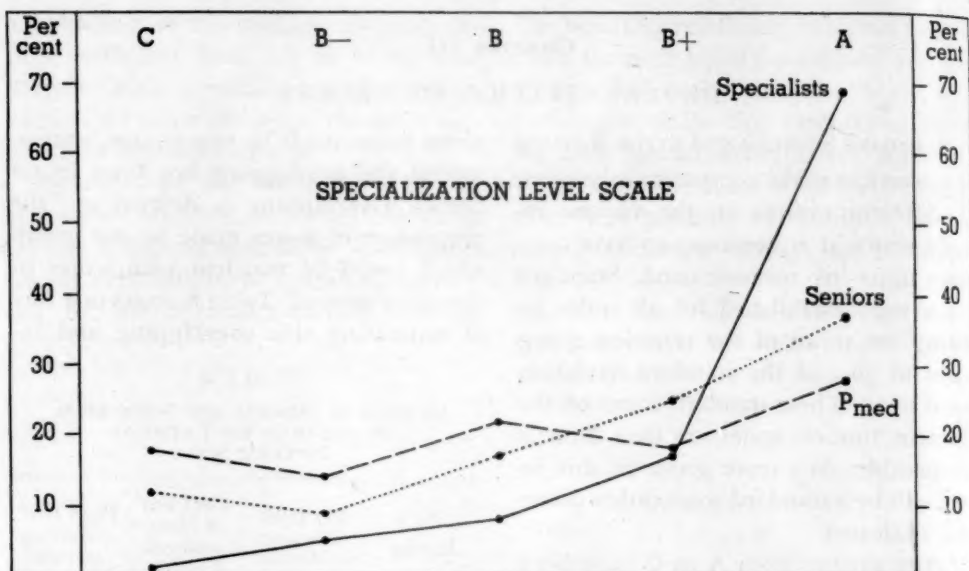


FIG. 1

Differentiation with the Specialization Level Scale
Per cent obtaining each letter rating.

Specialists = All internists, surgeons, pathologists and psychiatrists
Seniors = Medical school seniors
P_{med} = Physicians-in-general reference group

bankers 62%, personnel managers 47%, carpenters 43%, farmers 26%, and ministers 14% (5, p. 109f.).

It should be mentioned that overlap is often expressed as the percentage of a lower-scoring group which equals or exceeds the average of a higher-scoring group. This type of overlap will obviously be much smaller than the one indicated above. It is believed that the procedure used in this study is preferable for describing the total situation.

Some readers may be more familiar with correlation coefficients. The biserial correlation technique measures the relationship between two groups on a single continuous variable such as an interest scale. There appears to be a fairly direct relationship between r_{bis} and overlap in many situations. This relationship can

be roughly approximated as follows: $r_{bis} .90 = 30\%$ overlap, $r_{bis} .70 = 50\%$ overlap, $r_{bis} .50 = 70\%$ overlap, and $r_{bis} .30 = 90\%$ overlap. Note that the higher the r_{bis} the better is the differentiation between groups.

C. DIFFERENTIATION WITH THE SPECIALIZATION LEVEL SCALE

The Specialization Level Scale reflects the differences between all specialists, considered as a single group, and the physicians-in-general group. This scale was developed to help answer the question, "Should I specialize?"

Figure 1 indicates graphically the percentage of specialists, physicians in general, and medical school seniors obtaining each letter rating on the Specialization Level Scale. The points on the figure

representing the percentages in each category are connected by lines to facilitate reading. For example, the ratings of the specialists are distributed as follows: A rating 69%, B+ rating 17%, B rating 8%, B- rating 5%, and C rating 1%.

A larger proportion of the medical school seniors than of the physicians in general have an A or B+ rating on the Specialization Level Scale. This relationship suggests that younger doctors have more of the interests of specialists than do older physicians. (See footnote to Table 27.)

D. DIFFERENTIATION WITH THE FOUR SPECIALIST SCALES

The four scales, Internist, Surgeon, Pathologist, and Psychiatrist, are based

eral have an A rating on the Internist Scale. At the other end of the scale, C ratings were obtained by 25 per cent of the physicians in general and only 3 per cent of the internists. Similar information is given for surgeons, pathologists, and psychiatrists with respect to their own scales. Table 9 describes these comparisons in another manner.

The differentiation of the four medical specialty groups from the physicians-in-general group is good with an average overlap of 42 per cent. If we assume that our specialist scales are reasonably good measures of the interests of the specialists, we can make certain estimates. For example, the proportion of the physicians-in-general group having interests similar to those of internists is larger than the

TABLE 9
DIFFERENTIATION OF THE FOUR SPECIALIST GROUPS FROM PHYSICIANS IN GENERAL

Scale	Groups Compared	% Overlap	Biserial Correlation
Internist	Internists and P _{med} *	48	.73
Surgeon	Surgeons and P _{med}	42	.78
Pathologist	Pathologists and P _{med}	37	.83
Psychiatrist	Psychiatrists and P _{med}	41	.80
	Average	42	.79

* P_{med} = Physicians-in-general reference group.

on both the Vocational Interest Blank and the Medical Specialists Preference Blank. These scales reflect the differences in interests of groups of internists, surgeons, pathologists, and psychiatrists as compared to physicians in general and with each other. The effectiveness of these scales in differentiating the various groups will now be examined.

Figure 2 indicates graphically the distribution of internists and physicians in general on the Internist Scale. For example, 68 per cent of the internists and only 23 per cent of the physicians in gen-

proportion having interests similar to any of the other three groups. This apparent relationship seems reasonable. The activities of internists appear to resemble those of the average physician more than do the activities of surgeons, pathologists, and psychiatrists.

How well do the scales differentiate among the four medical specialist groups? Figures 3 and 4 indicate graphically the percentage of each specialty group obtaining each letter rating on each of the four scales. These charts are very similar in shape to those in Figure 2. This

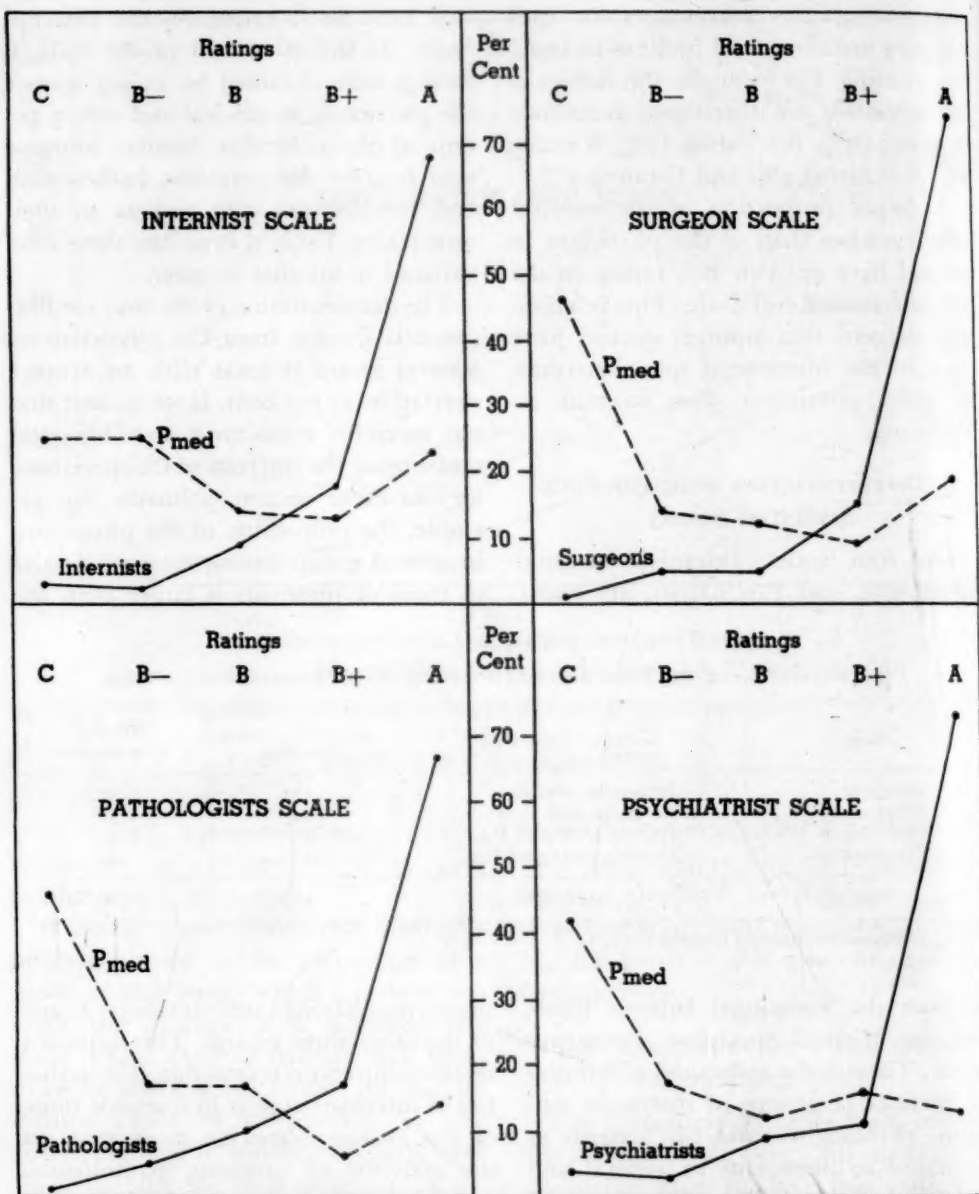


FIG. 2

Differentiation of Specialist Groups from Physicians in General
Per cent obtaining each letter rating

P_{med} = Physicians-in-general reference group

TABLE 10
DIFFERENTIATION AMONG THE FOUR SPECIALIST GROUPS

Scale	Groups Compared	% Overlap*	Biserial Correlation
Internist	Internists vs. Surgeons	31	.90
	Internists vs. Pathologists	61	.56
	Internists vs. Psychiatrists	60	.58
Surgeon	Surgeons vs. Internists	24	.95
	Surgeons vs. Pathologists	31	.89
	Surgeons vs. Psychiatrists	18	.99
Pathologist	Pathologists vs. Internists	53	.66
	Pathologists vs. Surgeons	44	.76
	Pathologists vs. Psychiatrists	42	.79
Psychiatrist	Psychiatrists vs. Internists	57	.63
	Psychiatrists vs. Surgeons	38	.83
	Psychiatrists vs. Pathologists	46	.75
	Average	42	.78

* Overlap computed by Tilton's formula (9).

means that the scales differentiate among the four groups of specialists about as well as they separate each specialist group from the physicians-in-general group. This is substantiated in Table 10 which indicates that the average overlap and average biserial correlation coefficient are about the same as in Table 9.

Surgeons appear to be the most homogeneous and unique of the four medical specialties. The overlap of the interests of internists with those of psychiatrists and pathologists is the largest. However, even here the differentiation is substantial. A biserial correlation of .56 (the lowest in Table 10) represents a high validity for most testing procedures. The average biserial correlation of .78 represents very high effectiveness. (See Technical Note F for consideration of cross-validation data.)

Another way of estimating the effectiveness of these scales is to consider how well they assign specialists to their own specialty. For example, what proportion of the internists will score higher on the

Internist Scale than on the Surgeon Scale, what proportion will be tied, and what proportion will show more of the interests of surgeons? Such comparisons are indicated in Figure 5. It should be noted that the "In Error" percentage undoubtedly contains some who actually should have been in another field on the basis of interests.

E. DIFFERENCES AMONG THE FOUR SPECIALIST GROUPS ON OTHER OCCUPATIONAL SCALES

Further differences between the four specialist groups are indicated by the scores on other occupational scales on the Vocational Interest Blank. These scales have been widely used for vocational guidance and were developed on the basis of differences between criterion groups in these occupations and the P_{men} (men in general) reference group. Average scores made by each of the specialist groups are shown in Table 11.

Specialists average slightly higher on the Physician Interest Scale than do

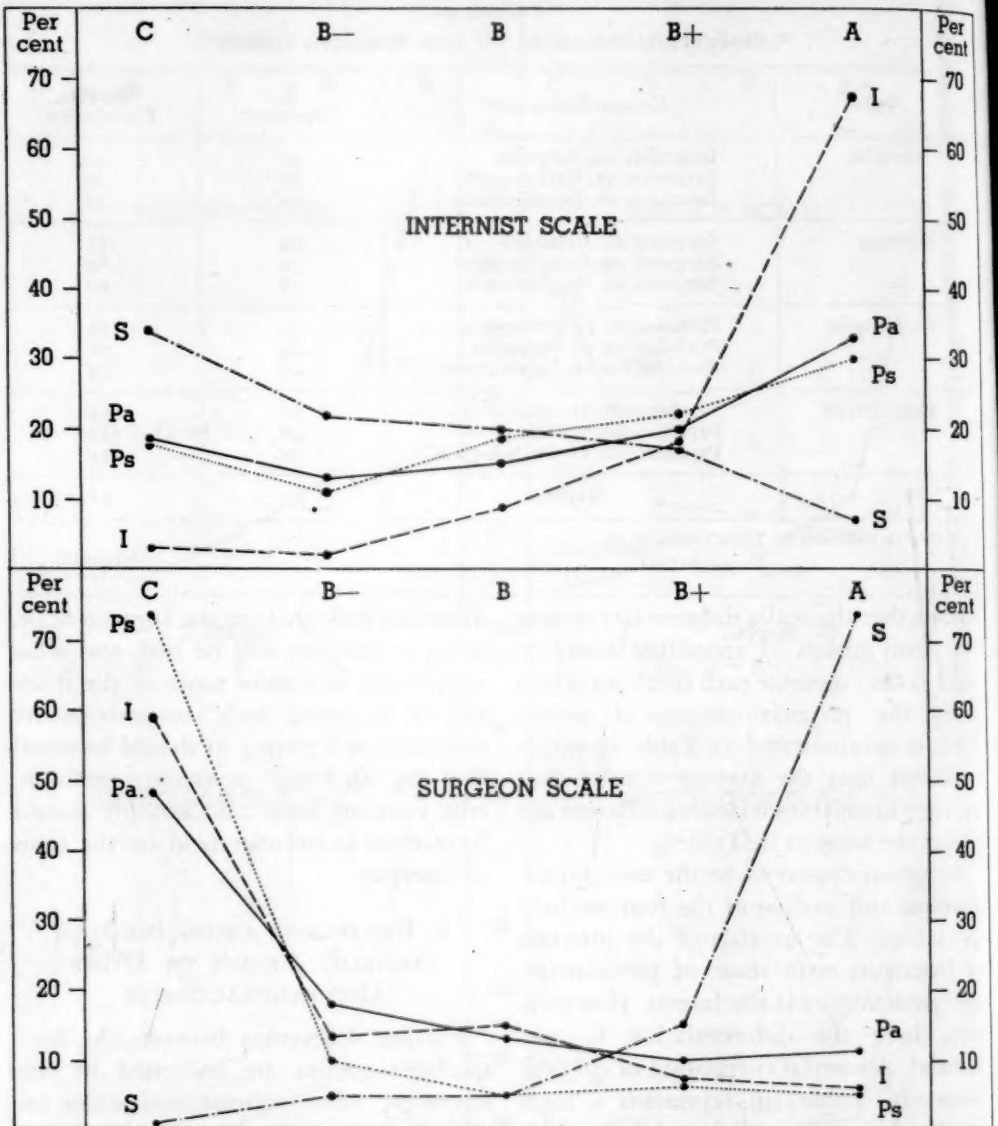


FIG. 3

Differentiation among Specialist Groups with
Internist and Surgeon Scales

Per cent obtaining each letter rating

I = Internists, $N = 291$

S = Surgeons, $N = 246$

Pa = Pathologists, $N = 124$

Ps = Psychiatrists, $N = 202$

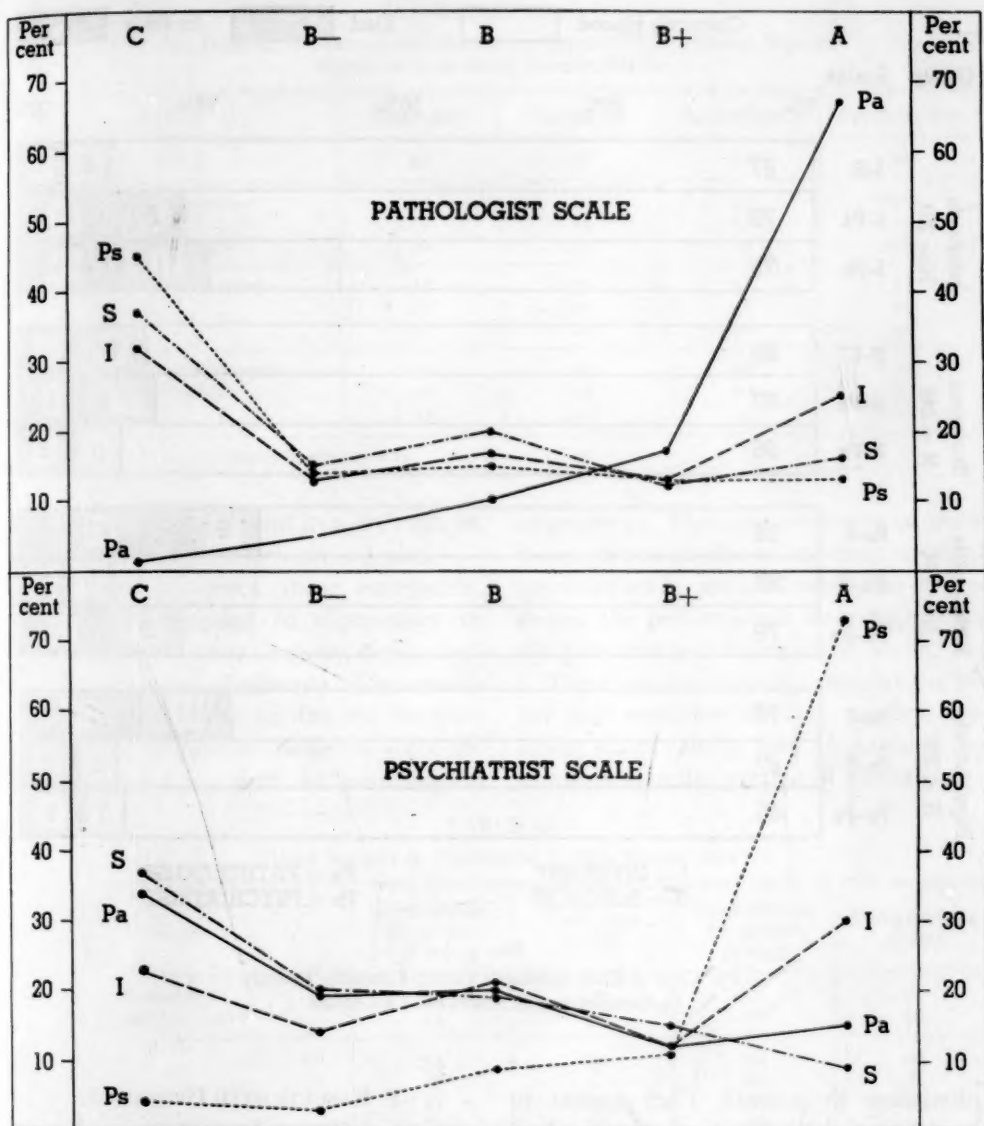


FIG. 4
Differentiation among Specialist Groups with
Pathologist and Psychiatrist Scales
Per cent obtaining each letter rating

I = Internists, $N = 291$
S = Surgeons, $N = 246$

Pa = Pathologists, $N = 124$
Ps = Psychiatrists, $N = 202$

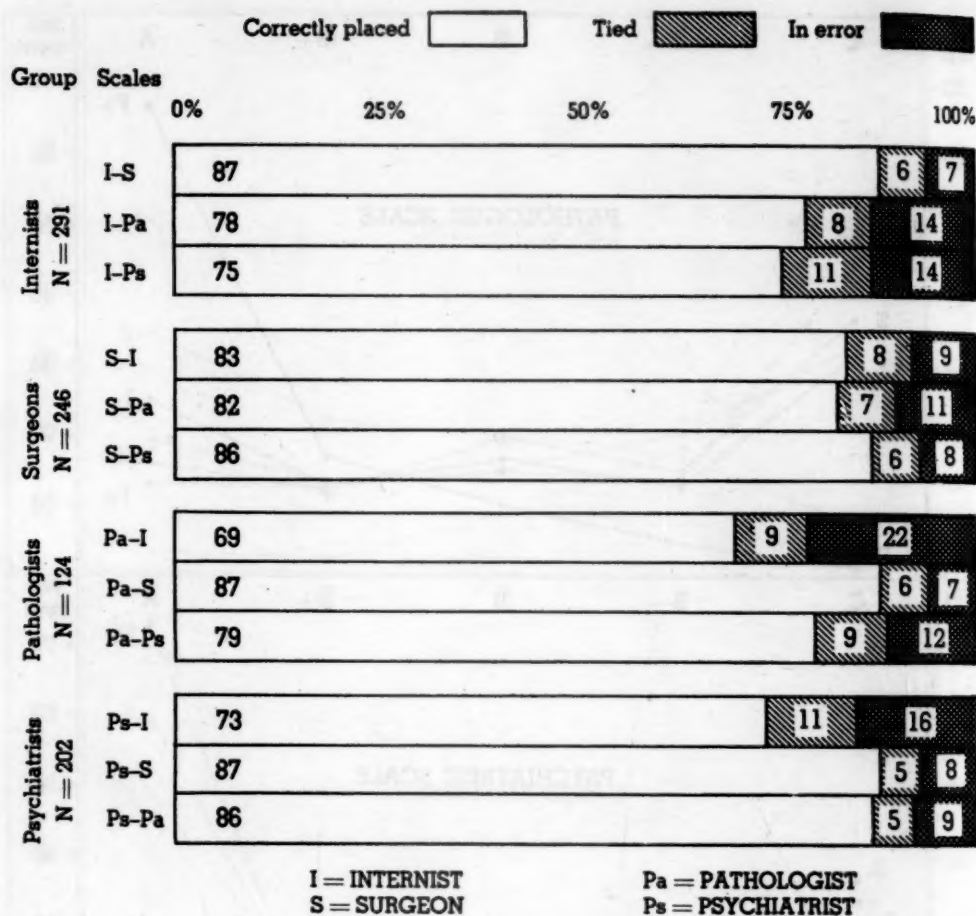


FIG. 5
Per Cent of Each Specialist Group Correctly Placed
by Comparison of Scores on Two Scales

physicians in general. They appear to have few of the interests of office workers or life insurance salesmen. Psychiatrists tend to have more of the interests of public administrators, personnel managers, and psychologists than the other three specialists. These relationships seem reasonable, as does the fact that the interests of pathologists are more like those of chemists than are those of the other specialists.

F. RESULTS WITH GROUPS OF OTHER SPECIALISTS

Can the scores of other types of specialists on the medical specialist scales be predicted on the basis of apparent similarity of activities? It was postulated, for example, that orthopedic surgeons, urologists, and neurological surgeons would score higher on the Surgeon Scale than on any of the other three scales. On the other hand, it was believed that

TABLE 11
MEAN SCORES OF SPECIALIST GROUPS ON OTHER OCCUPATIONAL SCALES*
(Based on Vocational Interest Blank)

Scales	Internists	Surgeons	Pathologists	Psychiatrists
Physician (rev.)	52	52	52	51
Public Administrator	42	40	41	46
Office Worker	24	24	22	23
Personnel Manager	32	31	29	39
Math-Science Teacher	37	36	38	37
Psychologist	41	36	42	46
Chemist	41	40	46	39
Life Insurance Salesman	26	27	22	28
Author-Journalist	37	34	37	37
Aviator	31	35	33	31

* Standard Deviations roughly approximate 10.

Letter Rating Equivalents: A = 45 and above, B+ = 40-44, B = 35-39, B- = 30-34, C = 29 and below.

pediatricians would tend to score high on both Internist and Psychiatrist Scales.

In order to check these statements, blanks were mailed to diplomates in Orthopedic Surgery, Urology, Neurological Surgery, and Pediatrics. The results are shown in Table 12. On the Surgeon Scale, the orthopedic surgeons score 46, the urologists 41, and the neurological

surgeons 45. The average scores of these three groups on the other three medical specialist scales are all lower. Also as predicted, the pediatricians score highest on the Internist and Psychiatrist Scales.

These results definitely support the belief that scores on the four medical specialist scales can be used to estimate the interests of other groups of specialists.

TABLE 12
MEAN SCORES OF GROUPS OF OTHER SPECIALISTS*

Scale	Orthopedic Surgeons N = 61	Urologists N = 82	Neurological Surgeons N = 43	Pediatricians N = 86
Physician (rev.)	51	49	53	51
Specialization Level	44	42	52	49
Internist	31	33	36	44
Surgeon	46	41	45	22
Pathologist	33	33	41	35
Psychiatrist	33	33	35	41
Public Administrator	41	38	41	42
Office Worker	26	27	23	26
Personnel Manager	31	29	32	32
Math-Science Teacher	40	38	36	40
Psychologist	34	32	38	41
Chemist	39	38	43	39
Life Insurance Salesman	24	26	24	25
Author-Journalist	30	31	34	34
Aviator	39	36	35	31

* Standard Deviations roughly approximate 10.

Letter Rating Equivalents: A = 45 and above, B+ = 40-44, B = 35-39, B- = 30-34, C = 29 and below.

TABLE 13
MEAN SCORES OF GROUPS OF NONSPECIALISTS*

Scales	Physicians in General N=100	Medical School Seniors N=150	Army Interns N=186	Army Command and Staff Medical Officers N=67
Physician (rev.) Specialization Level	50 39	51 42	49 44	35 42
Internist	36	34	30	30
Surgeon	31	31	31	32
Pathologist	30	27	28	32
Psychiatrist	33	38	39	38
Public Administrator	36	39	42	48
Office Worker	24	28	31	36
Personnel Manager	27	32	33	41
Math-Science Teacher	34	41	43	37
Psychologist	33	36	34	27
Chemist	37	36	36	28
Life Insurance Salesman	28	28	28	31
Author-Journalist	35	32	29	27
Aviator	32	38	39	33

* Standard Deviations roughly approximate 10.

Letter Rating Equivalents: A = 45 and above, B+ = 40-44, B = 35-39, B- = 30-34, C = 29 and below.

G. RESULTS WITH GROUPS OF NONSPECIALISTS

In addition to the physicians-in-general reference group there are three groups of nonspecialists for which data are available. Approximately 750 seniors in fifteen medical schools completed the blanks in the spring of 1951. These blanks were collected primarily for the purpose of a long-time follow-up study. However, a representative sample of 150 blanks (every fifth blank) has been scored. All interns in Army hospitals also completed the blanks in June 1951. A group of officers in the Army Medical Service who are performing primarily Command and Staff functions was identified by the Office of the Surgeon General; blanks have been returned by 67 of this group.

The mean scores of these nonspecialist groups are given in Table 13. The differences between the Army interns and the

medical school seniors are very small. This indicates that the young doctors entering the Army for internships are really representative of all medical school graduates with respect to interests.

The differences between the older physicians-in-general group and the younger medical school seniors are not great and may merely represent differences in emphasis in medical education. For example, there is a tendency for the young doctors to have interests more like those of psychiatrists, math-science teachers, and aviators than their older colleagues.

The most striking feature of Table 13 is the tendency of the Command and Staff group to deviate so markedly from the other three groups. The doctors in this group spend little time in actually caring for patients. Most of them have positions of responsibility in the administration of medical facilities or in making

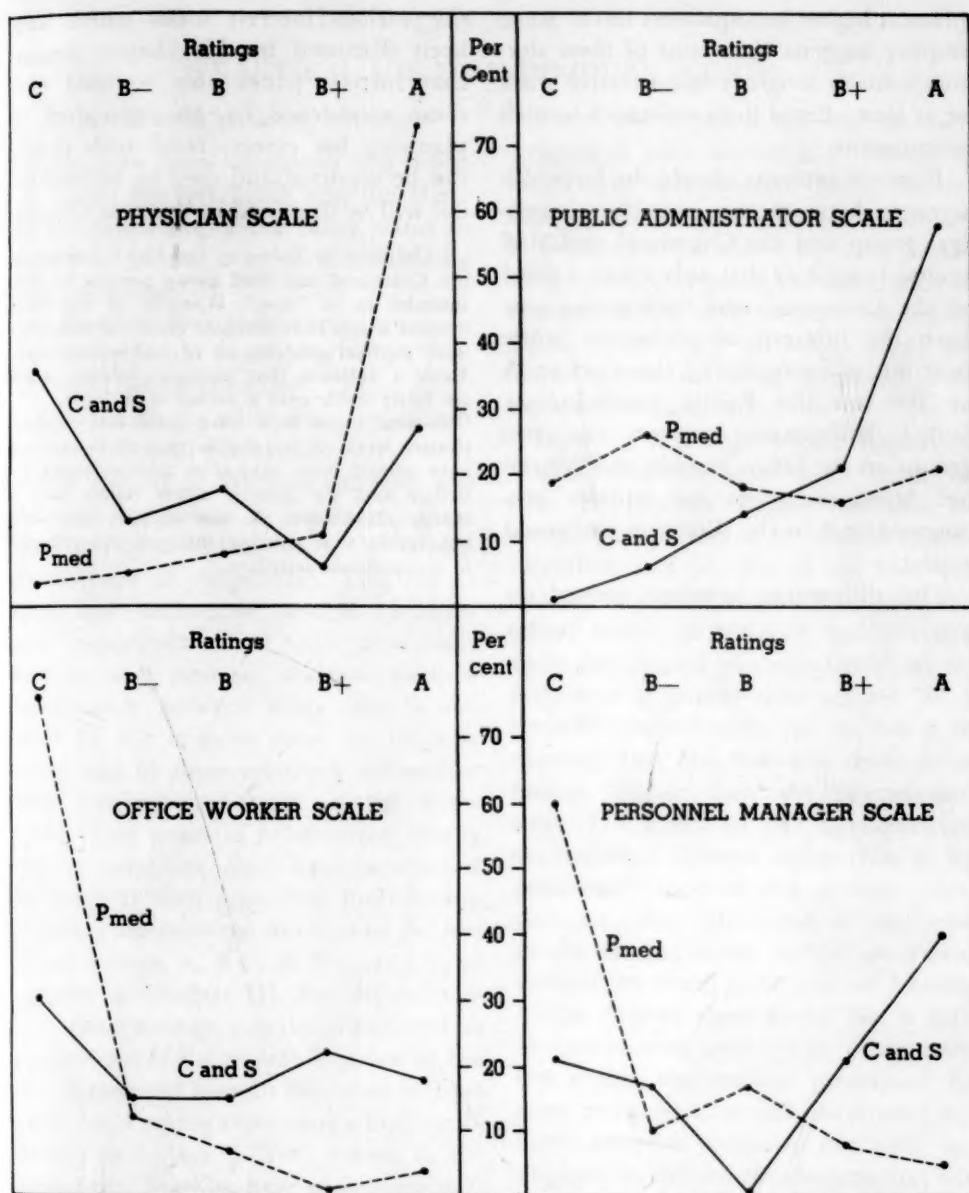


FIG. 6

Comparisons of Command and Staff Group
with Physicians-in-General Group
(Scales on Vocational Interest Blank)
Per cent obtaining each letter rating

C and S = Army Command and Staff Medical Officers Group.
Pmed = Physicians-in-general reference group.

plans at higher headquarters levels. Some inquiry suggests that most of these doctors actually sought administrative work or at least offered little resistance to such assignments.

Figure 6 presents clearly the large differences between the physicians-in-general group and the Command and Staff group. It appears that only about a third of the Command and Staff group now have the interests of physicians while four out of every five of them get an A or B+ on the Public Administrator Scale.¹ Differences between the two groups on the Office Worker and Personnel Managers scales are equally pronounced and in the direction we would expect.

The differences between groups on

the various interest scales which have been discussed in this chapter suggest that interest scores may be used with some confidence by an individual in planning his career. How such results can be reported and used by an individual will be discussed in the next chapter.

¹ The data in Table 13 and Fig. 6 concerning the Command and Staff group pertain to their interests as of "now." Whether or not their interest scores have changed from the time they were medical students is, of course, unknown. Table 2 indicates that physician interest scores are fairly stable over a period of 22 years.

Because these men have gone into administrative work, it is possible that their interests have shifted from clinical to administrative activities and the interest scores reflect such a change. Most data do not support this view but rather that existing interests are reflected in occupational activities.

CHAPTER IV

PRACTICAL USE OF INDIVIDUAL SCORES

A. REPORTING MEDICAL INTERESTS

THE man who completes the Vocational Interest Blank and the Medical Specialists Preference Blank wants an answer to one or more of the following four questions:

- a. Should I be a physician?
- b. If so, should I specialize?
- c. If so, which specialty?
- d. What about other activities within the medical profession?

The Report of Medical Interests will assist an individual in answering these questions by providing ratings on various scales (copy in Appendix). This report form has undergone several revisions after experimental use with physicians, interns, and medical students. It is a compromise between what may be desired by the research man, on the one hand, and by those relatively unfamiliar with psychological tests on the other hand. Two pages of information briefly answer questions which have been asked by medical men regarding their scores.

Scores are reported in terms of the five letter ratings, A, B+, B, B-, and C, as defined in Chapter III. For the individual, these ratings may be considered as expressions of the probability that he has the interests of men in the listed occupation. An A rating represents a high probability and gives a "Yes" answer to the question, "Does he have such interests?" Similarly a B+ rating means "Probably," a B means "Possibly," a B- means "Probably Not," and a C rating means "No, he does not have such interests."¹

¹ There is substantial evidence that the higher a man's vocational interest score the greater the probability that he has the interests of men in that occupation (5). The use of words such as

There are always a few men in each occupation who receive a C rating on their own occupational scale. Several analyses of such cases indicate that many of these men do not enjoy their work; others pursue atypical activities, such as superintendent of a hospital or health officer, where they no longer treat patients but do maintain membership in the medical fraternity.

Figure 7 is a copy of the Report of Medical Interests sent to an Army intern. His ratings suggest: (a) that he should be a physician, (b) that he should specialize, and (c) that of the four specialists, he should become a surgeon. His actual scores on SURGEON and PSYCHIATRIST are 52 and 36 respectively. As the difference is greater than 10, an "X" is recorded under "10+, yes" in No. 7, indicating that the SURGEON score is definitely higher than the PSYCHIATRIST score. His scores on the supplementary occupational interest scales (No. 8) approximate those of the average physician; i.e., they fall within or very close to the shaded areas, except on aviator interest, on which he obtains an A rating.

The shaded areas under No. 8 assist in interpreting interests in other activities within the medical profession. For some purposes it is well to consider how one's interests compare, not with men engaged in the ten occupations, but with doctors alone. The shaded areas provide the basis for such comparisons. Twenty-five per cent of physicians score above the shaded area, 50 per cent score within the shaded area, and 25 per cent below this

"Yes," "Probably," and "Possibly" to represent intervals along the gradient of interest scores has been found useful in understanding these scores.

REPORT OF MEDICAL INTERESTS

NAME DATE

ADDRESS

Your interests are similar to those of:

1. Physicians?

2. Medical specialists?

And of the four groups of specialists
considered:

3. INTERNISTS?

4. SURGEONS?

5. PATHOLOGISTS?

6. PSYCHIATRISTS?

C	B—	B	B+	A
No	Probably Not	Possibly	Probably	Yes
				X
				X
X				
				X
	X			
		X		

7. Where two or more specialists interests scores are about equal, your interests are more similar to (a) than to (b) as follows:

a. SURGEON..... b. PSYCHIATRIST

4—	5 to 9	10+
Tied	Probably	Yes
		X

8. Your Vocational Interest Blank has been scored on other scales and this supplementary information may be helpful to you.

a. Administrative Interests

Public Administrator

Office Worker

Personnel Manager

b. Teaching and Research Interests

Math-Science Teacher

Psychologist

Chemist

c. Persuasive Interests

Life Insurance Salesman

d. Linguistic Interests

Author-Journalist

e. Aviation Interests

Aviator

C	B—	B	B+	A
			X	
X				
		X		
X				
			X	
X				
			X	
				X

9. Comments,

FIG. 7

Medical Interests of an Army Intern

area. (It should be noted that this use of shaded areas is different from the range of chance scores indicated on the regular Report on Vocational Interest Blank.)

As an example, if a man's rating on

office worker is a B, it means that *possibly* he has the interests of office workers; but he has more of the interests of office workers than the great majority of physicians. Such a score suggests that he may like administrative work, or at least dis-

TABLE 14
AVERAGE RATINGS OF OTHER SPECIALISTS ON MEDICAL SPECIALISTS SCALES

Scales	Orthopedic Surgeons N=61	Urologists N=82	Neurological Surgeons N=43	Pediatricians N=86
Internist	B-	B-	B	B+
Surgeon	A	B+	A	C
Pathologist	B-	B-	B	B-
Psychiatrist	B-	B-	B	B+

like it less than most doctors. All administrators spend much of their time handling letters and report forms, the work of an office man.

It should be noted that scores on the four medical specialist scales (No. 3, 4, 5, and 6) should not be considered unless one has the interests of a physician. These scores are meaningless if one rates C or B- on the Physician Scale and questionable if one has a B rating. Since these scales were based on differences between groups of medical specialists and physicians in general, they presume a real interest in the medical profession as evidenced by a high score on the Physician Interest Scale. The meaning of scores on these scales for other groups is extremely problematical.

The Specialization Level Scale (No. 2) appears to be most useful in those cases having high ratings on No. 1 and low ratings on No. 3, 4, 5, and 6. Such scores suggest that one has the interests of medical specialists but not of one of the four for which scales have been constructed. Since there are some 32 recognized specialties in medicine, it would appear advisable to investigate carefully some of the other specialties.

How well will scores on the four specialist scales predict interest in other related fields? The specialties of urology and orthopedic surgery, for instance, appear to have much in common with the field of general surgery. Similarly cardiol-

ogy and dermatology appear closely related to internal medicine. It would appear reasonable to expect the interest scores in the four major specialty fields of internal medicine, surgery, pathology, and psychiatry each to represent the areas of related activities fairly well.

Data for four other types of specialists are given in Table 14. As was expected, the orthopedic surgeons, urologists, and neurological surgeons definitely tend to score higher on the Surgeon Scale than on the other three medical specialist scales. The higher average ratings of the pediatricians on the Internist and Psychiatrist Scales had been predicted on the basis of the professional activities of this group. This evidence, while not conclusive for all types of specialists, certainly supports the belief that a doctor considering any one of the many medical specialties would be aided by considering his results on the scales now available.

B. INTEREST PATTERNS OF GROUPS

Average ratings of physicians in general, senior medical students, Army interns, and Command and Staff officers in the Army Medical Service are indicated in Table 15. The first three groups have average ratings of A on physician interest, higher than on any other scale, which is to be expected. The Command and Staff doctors score only 35 on the Physician Scale, barely a B rating, which is indicative of the fact that

TABLE 15
AVERAGE RATINGS OF NONSPECIALIST GROUPS ON REPORT OF MEDICAL INTERESTS

Interests Similar to—	Physicians in General N=100	Medical School Seniors N=150	Army Interns N=186	Army Command and Staff Medical Officers N=67
1. Physicians	A	A	A	B
2. Medical specialists	B	B+	B+	B+
Specialists				
3. Internists	B	B-	B-	B-
4. Surgeons	B-	B-	B-	B-
5. Pathologists	B-	C	C	B-
6. Psychiatrists	B-	B	B	B
8. Other occupational scores				
a. Administrative Interests				
Public Administrator	B	B	B+	A
Office Worker	C	C	B-	B
Personnel Manager	C	B-	B-	B+
b. Teaching and Research				
Math-Science Teacher	B-	B+	B+	B
Psychologist	B-	B	B-	C
Chemist	B	B	B	C
c. Persuasive Interests				
Life Insurance Salesman	C	C	C	B-
d. Linguistic Interests				
Author-Journalist	B-	B-	C	C
e. Aviation Interests				
Aviator	B-	B	B	B-

TABLE 16
PER CENTS HAVING INTERESTS TO SPECIALIZE BASED ON A RATINGS ON PHYSICIAN SCALE,
SPECIALIZATION LEVEL SCALE, AND ON ONE OF THE SPECIALIST SCALES

Group	Type of Specialist				Total
	Internist	Surgeon	Pathologist	Psychiatrist	
Medical School Seniors	6	3	5	11	25%
Army Interns	3	2	4	16	25%
Command and Staff Officers	0	3	3	3	9%

they differ from other physicians.²

All four groups score about the same on the Specialization Level Scale (No. 2) and on the four specialist scales. The differences between the groups on the other occupational scales are in the directions that one would expect.

How many of each of these groups should become diplomates in each specialty on the basis of their individual interest? This is a crucial question. The

² See footnote 1, Chapter III.

answer to this question depends upon what standards are used in determining whether a man should specialize or not. If we require A ratings in physician and specialization interest and an A in one of the four specialist scales, then we have the data in Table 16. The results, if we lower the requirement to include those with either A or B+ ratings on the three scales, are shown in Table 17.

As was to be expected, the Command and Staff group contains a much smaller

TABLE 17

PER CENT HAVING INTERESTS TO SPECIALIZE BASED ON A OR B+ RATINGS ON PHYSICIAN SCALE, SPECIALIZATION LEVEL SCALE, AND ON ONE OF THE SPECIALIST SCALES

Group	Type of Specialist				Total
	Internist	Surgeon	Pathologist	Psychiatrist	
Medical School Seniors	15	10	6	22	53%
Army Interns	8	11	6	28	53%
Command and Staff Officers	1	4	6	8	19%

proportion of doctors who should specialize than do the other two groups. On the basis of interests alone, somewhere between one-quarter and one-half of the medical school seniors and Army interns should seriously consider specialty training. When other factors in addition to interest are considered, these proportions will be reduced appreciably.

It appears that a substantially larger proportion of the young doctors represented by these two groups have the interests of psychiatrists than of the other three specialists. Is this relationship caused by a faulty psychiatrist scale, or does it represent a real difference in interests of young doctors as compared to older ones? Reference to Table 9 indicates that both the Internist and the Surgeon Scales show less differentiation between the criterion group and the physicians-in-general group than does the Psychiatrist Scale. Since differentiation is one measure of the effectiveness of a scale, the Psychiatrist Scale is considered satisfactory. Table 13 shows the average score on the Psychiatrist Scale for the seniors and interns to be about six points higher than for the physicians in general. It thus appears that the younger doctors do tend to have more of the interests of psychiatrists than do the older doctors. Also, Army interns seem to have more of the interests of psychiatrists than do medical school seniors.

C. EXAMPLES OF INDIVIDUAL RECORDS

It may be helpful in understanding the use of these blanks to consider the records of a few individual cases. In Figure 7 was given the record of a man who meets all the interest requirements as to entry into medicine and specialization in surgery. Our data suggest that at least one-quarter of the young doctors will find that their interests indicate they would enjoy the advanced training and the narrowing of professional activities required of a specialist.

Table 18 (Doctor Y) gives the record of a Command and Staff Medical Corps officer with a very low score in Physician

TABLE 18
RATINGS OF TWO COMMAND AND STAFF
MEDICAL CORPS OFFICERS

Scale	Doctor Y	Doctor Z
Physician (rev.)	C	A
Specialization Level	B	B+
Internist	—	B
Surgeon	—	B+
Pathologist	—	C
Psychiatrist	—	B+
Public Administrator	A	A
Office Worker	B+	C
Personnel Manager	A	B+
Math-Science Teacher	B-	B-
Psychologist	C	B-
Chemist	C	B-
Life Insurance Salesman	B	B
Author-Journalist	C	B-
Aviator	C	B

interest, A ratings in Public Administrator and Personnel Manager, and a B+ rating in Office Worker. He does not treat patients and is an outstanding administrator.

Assuming that this man's interest scores have not changed appreciably since he was in medical school,³ we may ask, should this man have entered medicine? He has long since ceased to practice. But if he had not become a physician, he would not have risen to a prominent administrative position in the Army Medical Service. On the other hand, if he had entered some field other than medicine, he would probably have risen to an administrative position in that other area. Maybe it would have been a more important position than the one he now holds.

Should the Army take a man with this interest record for internship? The answer is "No" if they want him to prac-

tice medicine. If the Army wants doctors who are eventually to become administrators, it would seem preferable to take a man with an interest record similar to Doctor Z (see Table 18). This Command and Staff officer has an A rating on both Physician and Public Administrator scales. While he has made a fine record as an administrator, he devotes much of his time to clinical work.

In selecting Army interns a minimum requirement could be established for the Physician Interest Scale. If an A rating had been required, 76 per cent of the present class of interns would have been selected. Of those selected, 41 per cent would also have A ratings in Public Administrator. If the requirement had been an A or B+ rating on the Physician Scale, then 86 per cent of the present group would have been eligible, with 70 per cent of them having an A or B+ rating in Public Administrator.

³ See footnote 1, Chapter III.

CHAPTER V

SUMMARY AND CONCLUSIONS

A LARGE number of medical school graduates enter the Army each year to serve their internship, and many continue through residency training in one of the medical specialties. These doctors should be assigned to the type of training and work for which they are best fitted and in which they are most interested. To aid in making such assignments, the Surgeon General, U. S. Army, requested the "development of improved methods of guiding Army Medical Corps officers into specialty training. Emphasis will be placed on the development of measures of interest, motivation, and other personal factors, rather than on aptitudes or abilities."

This project was conceived primarily from a guidance, not a selection, point of view. It was recognized that any improved methods developed for guiding Army Medical Corps officers into specialty training would be equally useful to young civilian doctors planning their professional careers.

There are four questions that must be answered by a young man interested in a medical career, namely: (a) Should I be a physician? (b) If so, should I specialize? (c) If so, what specialty? (d) What about other activities within the medical profession? One important aspect of these questions involves job satisfaction and continuing high motivation in the work. Obviously, there are other aspects of these questions, such as aptitudes, abilities, and financial support, which were not considered in this research.

The results of several extensive follow-up studies of Stanford students extending up to 22 years were presented as evidence that scores on the Strong Vocational

Interest Blank do have considerable permanence and predict vocational behavior quite well. The Physician Interest Ratings of 670 Stanford students, of whom 108 were physicians twenty years later, were considered. Those students with an A rating in physician interest had 53 chances in 100 of becoming a physician; with a B+ rating, 20 chances; B rating, 12 chances; B- rating, 11 chances; and with a C rating, only 2 chances in 100. These studies lead one to expect that similar measures of interests of medical specialists would be useful in planning a medical career.

The primary problem of this research was to develop measures of interest and other types of preference which would differentiate the various types of medical specialists. Based on the evidence indicated above, it was believed that such measures would be predictive of continuing to enjoy working in a particular specialty. Only the four major specialties of Internal Medicine, Surgery, Pathology, and Psychiatry were studied.

The criterion groups consisted of diplomates certified by the American Boards in these four specialties; i.e., a surgeon was defined as a diplomate of the American Board of Surgery. A physicians-in-general reference group was randomly selected by the American Medical Association from their lists of all physicians in this country.

Two blanks were used for measuring interests. The Strong Vocational Interest Blank has been used for 25 years to measure the vocational interests of many different occupational groups. The Medical Specialists Preference Blank was developed specifically for use by the medi-

cal profession. Many of the items on this blank relate directly to the practice of medicine and more than half are of the forced-choice type, which does not permit an "indifferent" response. These items were first tried out on doctors in three large Army hospitals.

Each of these two blanks was mailed at different times to 1000 diplomates in each of the specialties of Internal Medicine, Surgery, and Psychiatry, and to 600 diplomates in Pathology. The initial mailing to the physicians-in-general group was 2500, but this was greatly reduced by the subsequent elimination of women and doctors over 55 years of age in the original listing. The samples on which item counts were made approximated 400 for each of the criterion groups. Data were also collected on smaller samples of the following: orthopedic surgeons, urologists, neurological surgeons, pediatricians, medical school seniors, Army interns, and Army Command and Staff medical officers.

Several types of scales were constructed, based on differences in the proportions of the various groups making different responses to each item. Weights varying from -4 to +4 were assigned to each item. There were scales which contrasted each specialist/group (a) with men in general, (b) with physicians in general, or (c) directly with each other specialist group. Scales were constructed using each of the blanks separately or based on both blanks combined.

A selected-item scale using both blanks, which maximized both the differentiation of the criterion group from the physicians-in-general group and from the other criterion groups, was found to be most effective. The results presented below are based on four such scales, one for each of the following types of spe-

cialists: Internist, Surgeon, Pathologist, and Psychiatrist.

Two other scales were developed. The item counts of the physicians-in-general group on the Vocational Interest Blank were used to construct a revised Physician Scale for use with that blank. This scale contrasts the interests of physicians with men in general and assists in answering the question, "Should I be a physician?" (See Technical Note D.)

A Specialization Level Scale was constructed based on the differences between all of the specialists, considered as a group, and the physicians-in-general group. This scale was designed to help answer the question, "Should I specialize?" (See Technical Note C.)

The results, in terms of differentiation between groups, can be summarized as follows:

1. A larger proportion of the medical-school seniors than of the physicians-in-general group have an A or B+ rating on the Specialization Level Scale. This relationship suggests that younger doctors have more of the interests of specialists than do the older physicians.

2. The Internist, Surgeon, Pathologist, and Psychiatrist Scales each differentiate the criterion group from physicians-in-general group exceptionally well (average $r_{bis} = .79$, range .73 to .83). These four scales also differentiate among the four specialist groups very well (average $r_{bis} = .78$, range .56 to .99). Surgeons appear to be the most homogeneous and unique of the four medical specialists. The overlap of the interests of internists with those of psychiatrists and pathologists is the largest.

3. It was postulated that orthopedic surgeons, urologists, and neurological surgeons would average higher scores on the Surgeon Scale than on the other

three scales. It was also believed that pediatricians would score highest on the Internist and Psychiatrist Scales. These hypotheses were definitely supported by the data on samples of these four specialists. In every case the average ratings on the other scales were at least two ratings lower than on the scales postulated to be high.

4. The three groups of nonspecialists—that is, medical school seniors, Army interns, and Army Command and Staff medical officers—average a B rating or less on the four medical specialist scales. These groups, as a whole, would not be expected to show the interests of a specialist group.

5. The Vocational Interest Blanks were also scored on several of the regular interest scales which contrast the interests of occupational groups with men in general. The psychiatrists tend to have more of the interests of public administrators, personnel managers, and psychologists than the other three specialists. The interests of pathologists are more like those of chemists than are the other specialties.

6. Among the groups of nonspecialists, the Army Command and Staff medical officers group deviates markedly on the regular interest scales from the other groups. It appears that only about a third of the Command and Staff group now have the interests of physicians, while four out of five get an A or B+ on the Public Administrator Scale. Average scores of this group on the Office Worker and Personnel Manager Scale are substantially higher than for the other medical groups. The doctors in this group spend little time in actually caring for patients. Most of them have positions of responsibility in the administration of medical facilities or in making

plans at higher headquarters.

The Report of Medical Interests was designed for use in reporting an individual's scores in such a way as to be most useful in his own planning. Scores are reported in terms of the five letter ratings, A, B+, B, B-, and C, which may be considered as expressing the probability that he has the interests of men in the listed specialty or occupation. An A rating means "Yes," a B+ rating means "Probably," a B means "Possibly," a B- means "Probably Not," and a C rating means "No, he does not have such interests."¹ The use of these results by an individual will be considered with reference to the four questions he must answer.²

a. Should he be a physician? An A or B+ rating on the Physician Scale supports his belief that he would enjoy the practice of medicine. A rating of B or lower suggests he should consider other occupations.

b. If so, should he specialize? A high score on the Specialization Level Scale indicates he has the interests of a specialist; i.e., he would probably enjoy the narrowing of his area of professional activities as well as the further training required of a specialist.

c. If so, what specialty? An A or B+ on the Internist, Surgeon, Pathologist, or Psychiatrist Scale indicates he probably has the interests of that type of specialist, *provided he has at least an A or B+ on the Physician Scale*. Since these scales measure the differences between specialists and physicians in general, the scores have no meaning unless one has the interests of a physician. While scales

¹ See footnote 1, Chapter IV.

² Other factors besides interest, such as aptitude, ability, and social need, must also be considered.

are available for only these four medical specialists, it is believed that these results can be used with some confidence to estimate how one's interests would probably correspond with those of other types of specialists. For example, cardiology and dermatology appear to be closely related to internal medicine. Such use of these ratings is definitely supported by the findings for orthopedic surgeons, urologists, neurological surgeons, and pediatricians.

d. What about other activities within the medical profession? Some physicians devote little or no time to the treatment of patients but, rather, engage in such activities as teaching, research, hospital administration, preventive medicine, marketing medical supplies, etc. The scores on the ten occupational scales on the Vocational Interest Blank may be helpful in considering many of the various activities within the medical profes-

sion. In addition to letter ratings indicating how one's interests compare with those of men in these occupations, shaded areas are marked to indicate the range of scores made by the middle 50 per cent of the physicians-in-general group. For example, if his rating on the Office Worker Scale is a B, he *possibly* has the interests of office workers; but he has more of the interests of office workers than the great majority of physicians.

Certain problems of methodology are discussed in detail in the six Technical Notes. The principles of differentiation and point of reference are elaborated in Technical Note A. A new method of selecting interest items so as to maximize differentiation among several criterion groups as well as between the criterion group and the reference group is presented in Technical Note B. The other four Technical Notes discuss other aspects of the research.

TECHNICAL NOTE A

DIFFERENTIATION AND POINT OF REFERENCE

1. *Differentiation*

DIFFERENTIATION has reference to differences, not similarities. The essence of being a physician consists of having those characteristics of physicians not found in other men. The sum total of all of these differentiating characteristics is what is meant by being a physician.

Differences exist between two or more things. In this research the things are groups of men. Such groups may be likened to spheres. The center of each sphere is the mean score of a test; the radius is expressed in terms of the standard deviation of the scores. Such spheres are not to be thought of as isolated in space but, rather, as overlapping one another. The better the differentiation the farther apart are the centers of the spheres and the less the spheres overlap.

On several occasions lists have been prepared of the characteristics of successful men in various occupations such as presidents of corporations, foremen, salesmen, etc. Such lists contain almost identical items. Little is gained by use of such lists, for all men, according to these lists, are far more similar than different. If an understanding of successful presidents is desired, the characteristics that distinguish such men from unsuccessful presidents, or vice-presidents, or from foremen, must be obtained.

In differentiating two groups it is necessary, first, to note the characteristics that distinguish them from each other and, second, to use devices to measure these characteristics. If the difference is a matter of stature, a tape is employed; if it is mathematics, an achievement test is used; if it is interests, an interest or preference blank is utilized.

The characteristics that differentiate two groups are present in individuals in both groups but in varying degree. The interest test of masculinity-femininity takes into account both mechanical interests possessed by men more than women and linguistic interests possessed by women more than men. Three lists of differentiating characteristics would need to be employed in the three cases where surgeons are contrasted with all M.D.'s, all college graduates, and all men in the country.

2. *Point of Reference*

If one is asked to comment on some coins, ranging from cents to silver dollars, he tells you that they differ in size, color, value, and metal composition. If he is asked to comment on the contents of a desk drawer, he mentions coins, rubber bands, paper clips, pencils, etc. If the request is made about one's study, the reply is desk, books, chairs, etc. In each case the individual unconsciously reacts in terms of the center of all the things to be noted. In the first case, the cent is smaller than the dollar. In the second case, all the coins are grouped in contrast to pencils, etc. In the third case, the coins are not mentioned, nor are the other contents of the drawer—they are all grouped into the term "desk," for everything in the room is noted in reference to the room as a whole.

Differentiation of groups of men is concerned not only with the peculiarities of the two groups, but also with points of reference. In differentiating medical specialists they are viewed as deviants from all medical men. They can also be thought of as deviants from all profes-

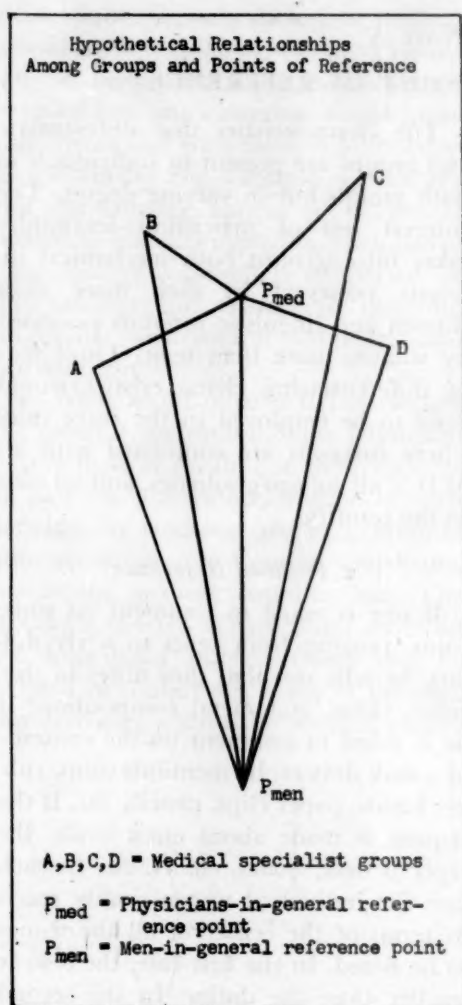


FIG. 8

sional men, or from all college graduates.

In this research two points of reference are used. The question, "Should this man be a physician?", means "Does he have the interests of a physician to a greater degree than he has the interests of an engineer, lawyer, accountant, and all the other occupations that college men are engaged in?" Since only college men become physicians, we do not concern ourselves with occupations not attractive to

TABLE 19
Correlations Represented by Figure 8

Part 1		
Physicians-in-general reference point		
Relationship	Angle in degrees	Correlation (angle cosine)
A - P _{med} - B	59	.51
A - P _{med} - C	162	-.95
A - P _{med} - D	133	-.69
B - P _{med} - C	101	-.20
B - P _{med} - D	163	-.96
C - P _{med} - D	64	.43
Average		-.31

Part 2		
Men-in-general reference point		
Relationship	Angle in degrees	Correlation (angle cosine)
A - P _{men} - B	10	.99
A - P _{men} - C	32	.85
A - P _{men} - D	40	.77
B - P _{men} - C	22	.93
B - P _{men} - D	30	.87
C - P _{men} - D	7	.99
Average		.90

college men. The point of reference in this case is an average of the men engaged in the occupations attractive to college men. This point of reference is designated as P_{men}.¹ It may be considered as the center of all the occupations young college men might consider entering. It is also the center of all the young men who might consider medicine as a career.

The second point of reference is used

¹ See footnote 1, Chapter I.

in connection with the question, "Which specialty should I enter?" This question can be stated: "Are my interests those of specialists; and if so, in which specialty would I most enjoy the work?" The only persons concerned with this question are practicing physicians, interns, and medical students. The point of reference is accordingly a physician-in-general group, referred to here as P_{med} .

In order to show how the statistics here employed measure the relationships expressed above with regard to P_{men} and P_{med} , Figure 8 is presented. This diagram is not drawn to any scale, nor based on specific data, and is presented solely to give a general idea of certain relationships. P_{men} is shown at the bottom of the figure and P_{med} in the center. The four letters, A, B, C, and D, represent four groups of medical specialists.

When interest scales are constructed differentiating the interests of medical specialists from P_{med} , the scales may be represented by the lines $A-P_{med}$, $B-P_{med}$, $C-P_{med}$, and $D-P_{med}$. Since each scale represents the *differences* in interests of physicians and a group of specialists, the interests pertinent to medicine are eliminated and the scale represents only the characteristics in which the specialty group differs from the average physician.

Correlations between the interests of two specialist groups—i.e., between A and B, A and C, A and D, B and C, etc.—are, strictly speaking, not between the two types of specialists but involve P_{med} also. The correlations are actually between (a) the differences in interests of A and P_{med} and (b) the differences in interests of B and P_{med} . In such a situation the correlation coefficient is equal to the cosine of the central angle, i.e., to the angle $A-P_{med}-B$. The angles between the

six combinations of A, B, C, and D and the corresponding cosines of these angles, which equal the correlations, are given in Part 1 of Table 19.

If interest scales are constructed differentiating the interests of medical specialists not from P_{med} but from P_{men} , the scales may be represented by the lines $A-P_{men}$, $B-P_{men}$, $C-P_{men}$, $D-P_{men}$. Here the interests peculiar to all men in occupations entered by college men are eliminated. But the interests of physicians as such are not eliminated and all four scales represent the differences between P_{men} and the interests of the average physician, modified somewhat by the variations in interests of the four specialties. When Groups A to D are contrasted in terms of P_{men} , the angles are all acute and so the cosines and correlations approximate 1.00, as shown in Part 2 of Table 19.

The Physician Interest Scale used to measure the interests of young college men who are considering which occupation to enter is represented in the diagram by the line $P_{med}-P_{men}$. The angles between $P_{med}-P_{men}-A$, $P_{med}-P_{men}-B$, etc. are all very acute angles. Hence the correlations will be high, which is appropriate, since the interests of physicians and of medical specialists are quite similar. The intercorrelations between scores of physicians and scores of the four specialist groups average .96 in the diagram, higher than the intercorrelations among the four specialist groups, when considered in terms of P_{men} (average .90). This relationship appears reasonable since specialists will agree more closely with all physicians than will each specialist agree with other specialists.

Table 19 gives two sets of correlations between specialists (A and D) which are

TABLE 20
INTERCORRELATIONS OF SCALES ON THE VOCATIONAL INTEREST BLANK BASED ON TWO
DIFFERENT POINTS OF REFERENCE
($N=285$ Stanford Seniors)

Scales	Scales (P_{men} Reference Point)				Scales (P_{med} Reference Point)			
	I	S	Pa	Ps	I	S	Pa	Ps
Internist	—	.909	.927	.846	—	.324	.365	.508
Surgeon	.909	—	.899	.792	.324	—	.118	.234
Pathologist	.927	.899	—	.770	.365	.118	—	.110
Psychiatrist	.846	.792	.770	—	.508	.234	.110	—
	Average = .857				Average = .276			

very different. The members constituting the specialist groups are identical and the relationships among them cannot, therefore, have changed. What has changed is the point of reference. In Part 1, the correlations are small or negative; that is, each specialist group appears to differ greatly from the others. This situation is comparable to looking at coins on a table. When coins alone are seen, the rather minute differences among them are noted. In Part 2 the correlations are large and positive; that is, the specialists appear as very similar. This is comparable to seeing coins mixed in with all the items in a desk drawer—they are just coins. Thus, when we consider men in the occupations entered by college men, the internists, surgeons, pathologists, and psychiatrists are just physicians.

As stated above, the diagram in Figure 8 was drawn more or less at random. The specific data given in Table 19 apply to this particular diagram. But the general relationships will hold regardless of

the figure used so long as P_{med} is located approximately in the center of A, B, C, and D; and P_{men} is located at some distance from P_{med} .

In contrast to Table 19, Table 20 gives the correlations between the scales, based on actual scores on the Vocational Interest Blank. When the four specialist groups are contrasted with P_{men} , the four scales correlate, on the average, .857 with each other. When the four specialist groups are contrasted with P_{med} , the four scales correlate, on the average, .276 with each other. The lower correlations and hence better differentiation of the scales based on P_{med} as compared to the scales based on P_{men} is readily apparent.

Maximum differentiation is obtained by contrasting groups with a point of reference which is located in the center of the groups. As the point of reference is located farther and farther away from the groups, the differentiation becomes less and less.

TECHNICAL NOTE B

DEVELOPMENT OF THE MEDICAL SPECIALIST SCALES

1. Introduction

THIS Technical Note explains the procedures used in developing the interest scales recommended in this report. In order to understand these procedures it will be necessary for the reader to keep clearly in mind the following four types of scales:

Type of scale	Based on differences between
A	Criterion group and P_{men} (men in general) reference group
BO	Criterion group and P_{med} (physicians in general) reference group
BS	Criterion group and P_{med} , modified by differences among specialist groups.
C	Each pair of specialist groups measured directly.

Using scales based on the Vocational Interest Blank only, it is demonstrated in Technical Note A that scales based on P_{med} have much lower intercorrelations than scales based on P_{men} . The type A scales for the medical specialists will, therefore, not be considered further in this section.

2. Evaluation of the BO Scales

The primary function of the BO scales is to differentiate each specialist group from P_{med} . This was accomplished very well when both blanks were utilized. Table 21 indicates that the average overlapping is only 39 per cent between specialist groups and P_{med} with a corresponding biserial r of .81.

It is also essential to the effectiveness of these scales that they differentiate among the four groups of specialists. If psychiatrists, for example, have nearly as high scores on the Internist Scale as the internists do, guidance based on such a scale is likely to be quite faulty. Actually,

differentiation between pairs of specialists is excellent in 7 of the 12 comparisons with an average overlap of 40 per cent (range 27 to 49). On 3 other comparisons the overlapping ranges from 59 to 64 per cent, which is still fairly good differentiation. But in 2 comparisons the overlapping is 76 and 85 per cent respectively, which represents too small differentiation to be of practical value.

The poorest differentiation involves internists in contrast to psychiatrists and pathologists. It is poorest between these groups on the Internist Scale.

In order to obtain some estimate of what differentiation was possible between pairs of specialists, the C scales were constructed. For this purpose each specialist group was directly contrasted with each of the others. The percentage of overlapping between the groups of specialists on these C scales is indicated in Table 22.¹ These data warrant the expectation that better differentiation can be obtained than resulted from the BO scales and, furthermore, that internists can be differentiated nearly as well as the other three specialists.

3. Weighting of Part Scores on BO Scales

Attempts to improve the BO scales proceeded along two different lines. The first attempt involved weighting parts of the blanks so as to give maximum differentiation. The second attempt involved selecting items to accomplish this purpose.

The problem of differentiating quali-

¹ It is recognized that the amount of overlapping may be spuriously low. In this situation the actual amount is not as important as the fact that the internists are differentiated relatively as well as the other groups.

TABLE 21
DIFFERENTIATION OF BO AND BS SCALES
($N=100$ for each group)

Scale	Groups Compared	BO Scales				BS Scales			
		Per Cent of Overlap			r_{bis} Both Blanks	Per Cent of Overlap			r_{bis} Both Blanks
		VIB Only	MSPB Only	Both Blanks		VIB Only	MSPB Only	Both Blanks	
Internist Surgeon Pathologist Psychiatrist	P_{med} vs. I	52	52	49	.71	57	54	48	.73
	P_{med} vs. S	46	39	34	.86	52	49	42	.78
	P_{med} vs. Pa	44	46	37	.83	43	50	37	.83
	P_{med} vs. Ps	40	47	38	.83	44	49	41	.80
Average		45	46	39	.81	49	50	42	.78
Internist	I vs. S	62	37	45	.75	53	30	31	.90
	I vs. Pa	85	68	76	.43	74	61	61	.56
	I vs. Ps	99	72	85	.23	75	55	60	.58
Surgeon	S vs. I	55	30	33	.88	40	31	24	.95
	S vs. Pa	67	45	47	.75	51	40	31	.89
	S vs. Ps	61	21	27	.93	38	25	18	.99
Pathologist	Pa vs. I	71	68	64	.53	59	61	53	.66
	Pa vs. S	53	48	44	.77	48	54	44	.76
	Pa vs. Ps	74	55	60	.59	53	50	42	.79
Psychiatrist	Ps vs. I	64	62	59	.59	60	62	57	.63
	Ps vs. S	49	32	35	.86	50	36	38	.83
	Ps vs. Pa	56	51	49	.71	52	47	46	.75
Average		66	49	52	.67	54	46	42	.77

VIB = Vocational Interest Blank
MSPB = Medical Specialists Preference Blank
 r_{bis} = Biserial correlation coefficient
 P_{med} = Physicians-in-general reference group
I = Internists
S = Surgeons
Pa = Pathologists
Ps = Psychiatrists

tative classes of individuals with a minimum of overlapping when one has several measurements on each individual can be solved statistically with Fisher's discriminant function. The data required

for the computation of this statistic consist of intercorrelations of the variables being measured and estimates of the effectiveness of each variable in differentiating between each two classes. The

TABLE 22
DIFFERENTIATION OF C TYPE SCALES
($N=100$ for each group)

Scale	Groups Compared	Percentage of Overlapping
Internist-Surgeon	Internist vs. Surgeon	23
Internist-Pathologist	Internist vs. Pathologist	39
Internist-Psychiatrist	Internist vs. Psychiatrist	37
Surgeon-Pathologist	Surgeon vs. Pathologist	21
Surgeon-Psychiatrist	Surgeon vs. Psychiatrist	24
Pathologist-Psychiatrist	Pathologist vs. Psychiatrist	28
	Average	32%

computational procedures involved in determining the weights to be applied to the variables for maximum differentiation between two classes are relatively simple. For more than two classes the computations become very complex.

Intercorrelations between the 14 parts of the two blanks on each of the four scales were computed. Means and standard deviations for each of the four groups of specialists were computed on each of the 14 parts on each of the four scales. Punched card machine methods were used in making these computations.

A number of solutions using the discriminant function method were worked out between successive pairs of specialties. The effectiveness of using the resulting part-score weights was evaluated by estimating the percentage of overlapping between the various classes.

Some improvement in the discrimination between certain groups of specialists could be accomplished by the use of weighted part scores. However, such improvement required a great reduction in the number of part scores being weighted and poorer differentiation among other groups.

It became apparent that these part scores were not measuring separate variables in the sense of being fairly homogeneous and somewhat independent. The use of differential weights for the several part scores of the two blanks did not appear to be the best method of improving the effectiveness of the scales.

4. Selection of Items for BS Scales

It became obvious that occupational items, for example, do not measure a different interest from amusement items. Actually, one combination of occupations and amusements is liked by internists, another combination by surgeons, and so

on. The second attempt to improve the scales *viewed each item as a separate test*, just as parts of a battery are viewed as separate tests. As it was impossible to handle 571 items as one does ten or fifteen tests in a battery, some other approach than Fisher's discriminant function had to be devised.

The procedure followed in selecting items for the revised BO scales, called BS scales, is illustrated in Table 23, where four items are considered in detail. For each of the four items the percentages of like, indifferent, and dislike responses to the item by P_{med} and each of the four specialists groups are given. The weights assigned the item are obtained directly from a table which gives every possible combination of 0 to 100 per cent. Thus, in the case of item No. 4, the percentage of 16 for liking by internists is contrasted with the percentage of 21 by P_{med} and the table gives a weight of 0. Similarly the percentage of 23 for indifference by internists is contrasted with the percentage of 30 by P_{med} and the table gives a weight of 1. Since fewer internists are indifferent to the item than P_{med} , the negative sign is attached, so that the weight reads -1. In the same manner a +1 weight is assigned dislike since 61 per cent of internists dislike the item in contrast to 49 per cent of P_{med} . Only zero weights are obtained from the table when the responses of surgeons, pathologists, and psychiatrists are contrasted with the responses of P_{med} .

This procedure was used in weighting items for the BO scales. In this case item No. 4 is used on the Internist Scale, but not on the other three BO scales. The weights assigned to differences in percentages of responses are based on Kelley's formula in which the correlation between responses determines in large

TABLE 23
ILLUSTRATING THE SELECTION OF ITEMS FOR BS SCALES

Item	Group	Percentage			Weights			<i>d</i> Score on Internist Scale
		Like	Indif-ferent	Dis-like	Like	Indif-ferent	Dis-like	
No. 4	P _{med}	21	30	49				I Scale
	I	16	23	61	0	-1	1	19
	S	16	30	54				38
	Pa	19	32	49				24
	Ps	23	29	48				17
No. 10	P _{med}							I, S & Ps Scales
	I	52	31	17	2	-1	-1	56
	S	70	25	5	2	-1	-1	110
	Pa	71	22	7	2	-1	-1	113
	Ps	75	21	4	2	-1	-2	125
		77	18	5	2	-1	-1	131
No. 6	P _{med}							I, Pa Ps Scales
	I	36	39	25	1	0	-1	11
	S	45	38	17				28
	Pa	37	38	25				12
	Ps	48	40	12	1	0	-1	36
No. 17	P _{med}							I Scale
	I	28	42	30	-1	0	0	-28
	S	22	45	33				-22
	Pa	36	42	22	1	0	-1	-36
	Ps	28	40	32				-28
		28	44	28				-28

P_{med} = Physicians-in-general reference group
I = Internists
S = Surgeons

Pa = Pathologists
Ps = Psychiatrists

part the weight (4, 5).

With item No. 10 we have a case where the item was used on all four BO scales. Weights of 2, -1, and -1 were assigned responses of liking, indifference, and disliking, respectively, on the Internist, Surgeon, and Psychiatrist Scales, and weights of 2, -1, and -2 on the Pathologist Scale. Once the four weights are brought together it is evident that use of this item on all four scales will produce a high correlation among them.

To explain the revision it is necessary at this point to define *d* scores. Given an item with *n* responses to each of which are attached scoring weights, then a

man's score on the item is $W_1 R_1 + W_2 R_2 + W_3 R_3 + \text{etc.}$ where *W* equals the weight and *R* equals the man's response (viz., "1" if he marks that response, and "0" if he does not). The sum of such totals for all the items in the test is the man's raw score. So far the procedure is exactly that employed in scoring the man's blank on the scale.

Similarly, the mean score of *n* persons on a single item is

$$1/N [(W_1 \times \text{number replying}) + (W_2 \times \text{number replying}) + (\text{etc.})].$$

Thus, if 80 physicians like "surgeon," 14 are indifferent, and 6 dislike the

activity and the weights are, respectively, 4, -1 and -4, then the mean score on the item is

$$1/100 [(4 \times 80) + (-1 \times 14) + (-4 \times 6)] \text{ or } 2.82.$$

The sum of such totals for all the items in the test is the mean raw score of the group.

By this procedure the mean score of a group can be obtained without scoring the individual blanks on the appropriate scale. All that is needed are the weights for the different responses to each item and the tally of responses of the group (6).

The *d* score is the total, not mean, score of 100 persons on a single item. In the above example it would be 282, not 2.82. Such *d* scores indicate the contribution of each item for each of the four specialist groups on each of the four scales. Table 23 shows the contribution of item No. 4 on the Internist Scale to be 38 for internists, 24 for surgeons, 19 each for P_{med} and psychiatrists, and 17 for pathologists. This is a poor item, approaching the lower limit of acceptability.

Three standards were set up in terms of which items on the BO scales were accepted for the BS scales. First, an item was rejected if higher *d* scores were obtained by any specialty group than the group for which the scale was designed. Second, an item was retained only if its *d* score was greater by 6 or more than the average of the *d* scores on the other three scales. It is not necessary to consider the P_{med} *d* scores since such scores cannot exceed the *d* scores for a group on its own scale, so long as the weights are properly assigned. Since the revision was undertaken to increase the differentiation between internists and psychiatrists, and

between internists and pathologists—particularly with the Internist Scale—a third standard was maintained, namely, to accept items that discriminated in these directions even if they did not discriminate between internists and surgeons.

Consider now the application of these three standards to item No. 10 in Table 23. The weights for Internist, Surgeon, and Psychiatrist BO Scales are 2, -1, and -1. The psychiatrist *d* score is 131, which is higher than the *d* scores for the other groups and also the 131 exceeds the average of the other three *d* scores, i.e., 115, by 16. The item is accepted for the Psychiatrist Scale and rejected for the Internist and Surgeon Scales. The weighting is different for the Pathologist Scale, but pathologists have a lower *d* score than psychiatrists on that weighting; consequently, the item is rejected for the Pathologist Scale.

As far as the first two standards go, item No. 6 should be used in the Pathologist Scale since the pathologists have a higher *d* score than the other three groups and its *d* score is more than six greater than the average of the other three *d* scores. But it discriminated very little between internists and either pathologists or psychiatrists where greater discrimination was desired, while it discriminated considerably between pathologists and surgeons where the discrimination was already ample. The item was accordingly rejected.

Item No. 17 is an example of an item that can be used successfully on two different scales. This is because the weights are reversed on the Internist and Surgeon Scales. The item contributes very little to the Internist Scale, barely meeting our requirements, but it makes a good contribution to the Surgeon Scale.

TABLE 24
DIFFERENTIATION OF INTERNISTS FROM OTHER GROUPS ON THREE INTERNIST SCALES
(Vocational Interest Blank Only)

Group	I _a (BS) Scale		I _b Scale		I _c Scale		Per Cent Overlapping with Internists		
	Raw Mean	SD	Raw Mean	SD	Raw Mean	SD	I _a Scale	I _b Scale	I _c Scale
Internist	13.5	8.92	6.7	7.3	22.86	12.94	—	—	—
Surgeon	1.12	10.84	1.8	6.6	19.4	10.7	53	73	88
Pathologist	6.91	11.04	4.16	7.0	24.06	11.68	74	86	-96*
Psychiatrist	7.14	10.94	7.78	6.18	27.36	11.48	75	-94	-85
P _{med}	1.62	11.82	-.96	7.74	9.52	12.36	57	61	60

* Minus sign indicates the group scores higher than internists.*

I_a Scale = 65 items selected for BS Internist Scale.

I_b Scale = 21 items which approximate standards for BS Scale.

I_c Scale = 96 items which are definitely below BS standard.

It might be pointed out that negative *d* scores are as useful as positive *d* scores provided they meet the two standard requirements.

Table 24 illustrates what happens when items are selected on the above basis for the Internist Scale on the Vocational Interest Blank. There were 182 items on the Internist BO Scale on the Vocational Interest Blank. Only 65 were selected for the BS Scale. Of the remainder, 21 items closely approximated the standards set up for selection and 96 were definitely rejected. These three groups of items were scored separately as though they were separate scales and are referred to as scales I_a, I_b, and I_c, respectively. The I_a scale is markedly better than the I_b scale, and both are clearly superior to the I_c scale. On this third scale both pathologists and psychiatrists score higher than internists. The superiority of the I_a scale over the other two scales is shown also in terms of overlapping. Internists and psychiatrists overlap only 75 per cent on scale I_a and overlap -94 and -85 per cent on scales I_b and I_c, respectively. The minus signs indicate that the overlapping is in the wrong direction; namely, that psychiatrists score

higher than internists on the Internist Scale.²

5. Evaluation of the BS Scales

Comparisons of the effectiveness of the various BO and BS scales are given in Table 21. When both blanks are used, the average overlapping of specialist groups with one another is decreased from 52 to 42 per cent, which represents an increase in the average biserial correlation from .67 to .77. The poorest differentiation, represented by an overlap of 61 per cent and an r_{bis} of .56, is still fairly good.

It may help to understand these results to note that physicians and engineers overlap 42 per cent on the Engineer Scale on the Vocational Interest Blank. The medical specialist scales differentiate, on the average, one specialist group from another and from P_{med} to the same degree that physicians are differentiated from engineers.

The BS scales are a real improvement from the standpoint of validity, especially in differentiating internists from psychiatrists and pathologists. But they contain

² See footnote 1, Technical Note B.

far fewer items and, presumably as a result, they have lower reliability.

If the number of items is plotted against the reliability, two things are evident. First, there is an almost direct relationship between the number of items and the odd-even estimates of reliability, if data from the BO and BS scales are considered separately. Second, the BS scales achieve a higher reliability per number of items used than do the BO scales. Approximately 300 items are needed for a reliability of .89 on the BO scales in contrast to 225 items on the BS scales. Evidently, the selected items have higher reliability than the rejected items.

The subject of reliability is discussed in detail in Technical Note F. It was decided to use the BS scales rather than the BO scales on the ground that validity is more important than reliability.

6. Limitations of Selected-Item Procedure

Where the objective is to differentiate subgroups from the total and at the same time subgroups from one another, the selected-item procedure is superior to the usual method of selecting interest items. The procedure has been successful when four medical specialist subgroups have been contrasted. It seems at this time that such a procedure could not be employed if as many as ten subgroups were to be so differentiated. Theoretically it could be done, as far as we know; but from the practical point of view, it is very doubtful.

With the selected-item procedure, an item involving two possible responses, such as the forced-choice items of the Medical Specialists Preference Blank, can be used on only two scales; and an item involving three possible responses can

be used on only three scales. On the typical like-indifferent-dislike item, weights such as -1, 1, 0; -2, 0, 2; and 1, -1, -1 could be used on three different scales. If all the 571 items on both blanks were used to theoretical capacity, this would mean that the average item would be used on 2.79 scales. But actually the items were used, on the average, on only 1.13 scales.

Assuming that 225 items are needed to give a reliability of .89, it means that 199 items are actually needed per scale, as each item is used on 1.13 scales. For four scales 796 items would be needed, 225 more than on the present two blanks. For 10 scales 1990 items would be necessary, which would require 1419 new items.

It is doubtful if 1419 additional good items could be found without great difficulty. It is, of course, to be expected that some of the items not used on the present four scales would be used on the six new scales and some of the present items not used to capacity could also be used more fully. Nevertheless, the number of new items necessary for ten scales presents an almost impossible task. Another objection to using a test of 1990 items is that very few would voluntarily fill out such a blank, so that it would be difficult to obtain the necessary data from criterion groups to develop the scales.

A more feasible procedure would be to determine the relationship of the other medical specialist groups to the present scales. It is likely that a number of specialist groups will be found closely allied to one of these four groups. Thus, urologists and orthopedic surgeons tend to score like surgeons and not like internists, pathologists, or psychiatrists. The present scales may thus be shown to predict interest in the four specialties and also in a

considerable number of the remaining specialties.

Once it is established that certain specialists are primarily like surgeons as distinct from internists, pathologists, and psychiatrists, it might be possible to establish scales for these specialist groups, not in terms of P_{med} but in terms of a

point of reference composed entirely of surgeons. Medical students could be scored on the present four BS scales plus additional scales which would indicate whether their interests were, for example, like surgeons, or like urologists, orthopedic surgeons, or neurological surgeons.

TECHNICAL NOTE C

THE SPECIALIZATION LEVEL SCALE (3)

By Milton G. Holmen, Ph.D.

THE Specialization Level Scale was constructed to help the young doctor answer the question, "Should I specialize?" The first step in developing this scale was to average the responses of the four specialist groups (internists, pathologists, psychiatrists, and surgeons) to each possible response on the Vocational Interest Blank and the Medical Specialists Preference Blank. The responses of each specialist group were given equal weight in computing the averages used as the responses of the medical specialist group. Then the responses of the specialists were compared with those of the P_{med} (physicians in general) reference group. Weights were assigned as described in Technical Note B for the BO scales.

The four specialist groups differ somewhat from each other. It was believed that averaging the responses of the four groups would eliminate any group peculiarities. It was thought, also, that subtracting the responses of physicians in

general from the averages of the four specialist groups would eliminate medical interests as such from the scale and leave only the interests of specialists. These interests of specialists should, thus, be relatively independent of the field of specialization.

A Specialization Level Scale was developed for each of the two blanks by performing the computations illustrated in Table 25, for each of the items on the Vocational Interest Blank and the Medical Specialists Preference Blank. The Specialization Level Scale on the Vocational Interest blank contains 240 weights on 149 items. The scale on the Medical Specialists Preference Blank has 94 weights on 71 items.

The reliability (split-half corrected by the Spearman-Brown formula) of the scale using both blanks is .79. The Vocational Interest Blank part of the scale has a reliability of .77, and the Medical Specialists Preference Blank part of it has a reliability of .47. The blanks used for obtaining this reliability were those of 100 physicians in general. A test-retest procedure would have been preferable as an estimate of reliability, but the practical problems involved in getting test-retest scores on this group more than offset the advantages to be obtained by their use. The reliability of only .47 for the Medical Specialists Preference Blank part of the scale obviously precludes use of this blank by itself. The reliabilities of .77 and .79 are lower than one might desire, but not so low as to preclude use of the scale, if this fact is kept in mind when interpreting the scores.

In developing norms for the scale, the

TABLE 25

ILLUSTRATION OF METHOD OF DETERMINING WEIGHTS FOR AN ITEM ON THE SPECIALIZATION LEVEL SCALE

Groups	Per Cent Responding		
	Like	Indifferent	Dislike
Surgeons	65	28	7
Internists	50	35	15
Psychiatrists	55	29	16
Pathologists	82	16	2
Mean of Specialists	63	27	10
Physicians in General	51	36	13
Difference	12	-9	-3
Weight assigned	1	-1	0

TABLE 26
STATISTICAL CHARACTERISTICS OF DISTRIBUTIONS OF SCORES ON THE SPECIALIZATION LEVEL SCALE

Group and Measure	Vocational Interest Blank	Medical Specialists Preference Blank	Both Blanks
Medical Specialists			
Mean	50	50	50
SD	10	10	10
Physicians in general			
Mean	38.33	43.36	39.03
SD	10.20	9.65	9.85
Difference between means			
Mean difference	11.67	6.64	10.97
SD of Diff. between Means	1.14	1.09	1.10
Critical Ratio of Diff.	10.24	6.09	9.97

Correlation between scores on the two blanks = .47

blanks of 100 specialists in each of the four fields were scored on the scale. The scores of this group ($N = 400$) were then transmuted into standard scores so that the distribution had a mean of 50 and a standard deviation of 10.

The standard scores on the Specialization Level Scale were then obtained from the blanks of 100 physicians in general. These scores were compared with those of the specialists. The test used to determine the significance of the difference between the two distributions was the critical ratio obtained by dividing the difference between the means by the

standard error of that difference. Table 26 presents these means, standard errors, and critical ratios. These data clearly indicate that the two groups are separated by the use of each blank separately and by the two blanks combined.

A more practical measure of the usefulness of this scale is how well it actually classifies members of various groups into the categories of "A," "B," etc. The distributions of the four groups of specialists and of three other medical groups are shown in Table 27.

Research on the Vocational Interest Blank section of the Specialization Level

TABLE 27
DISTRIBUTIONS OF RATINGS OF VARIOUS MEDICAL GROUPS ON THE SPECIALIZATION LEVEL SCALE

Group	Per Cent Obtaining Each Rating				
	A	B+	B	B-	C
Internists	69	16	9	5	1
Pathologists	68	19	8	3	2
Psychiatrists	86	8	4	1	1
Surgeons	52	24	10	12	2
Medical Specialists	69	17	8	5	1
Physicians in General*	28	18	22	14	18
Medical School Seniors	37	25	17	9	12
Army Command and Staff Medical Officers	37	22	16	13	12

* Since physicians in general were used in constructing the scale, their ratings are probably spuriously low. However, an average change of less than one standard score would be expected on another similar sample (S. p. 647).

Scale has yielded some interesting findings. Within three nonmedical subject-matter areas (social science, physical science, and accounting), occupational groups are ranked in the same order by their mean specialization-level score as by their mean educational-level. This may be taken to indicate that the scale measures liking for advanced education. To test whether this relationship would hold where the education was not of a specialized nature, scores of two groups of graduate students in business administration were obtained. These students had been enrolled in the Stanford Graduate School of Business working for the degree of Master of Business Administration. Half of them received this degree, and the other half dropped out or failed before

completing the requirements for it. The Specialization Level Scale does not separate these two groups.

The Specialization Level Scale does separate chemists with Ph.D. degrees from those having M.S. degrees and those having B.S. degrees. The separation of chemists with M.S. degrees from those with B.S. degrees is not at a significant level (CR of .81), but is in the expected direction. Since advanced training in chemistry is highly specialized, and that in the Graduate School of Business is intended to be broadening, we may tentatively accept the hypothesis that what the scale measures is willingness to narrow one's vocational activities, as required of a specialist, rather than mere tolerance for advanced education.

TECHNICAL NOTE D

PHYSICIAN AND PSYCHIATRIST SCALES ON THE VOCATIONAL INTEREST BLANK

THE guidance of college men and potential college men has been assisted by the many interest scales of the Vocational Interest Blank for Men. These scales are based on the P_{men} (men in general) reference group which is representative of men in occupations normally entered by men with a college education and is thus not representative of all men.

This Technical Note discusses two scales for the Vocational Interest Blank. There has been a Physician Scale for many years which has helped answer the question, "Should I be a physician?" This scale has been revised as part of this research project. The original and revised physician scales are compared.

The possible need for a psychiatrist scale in addition to the physician scale for use with college students will also be discussed. As compared to men in general, are the interests of psychiatrists substantially different from those of the average physician?

1. *Revision of Physician Scale*

The revised physician scale for the Vocational Interest Blank is based on the P_{med} (physicians in general) reference group. This sample of 500 physicians is representative of all physicians in the country. Surprisingly good agreement has been obtained between scores on the original scale and subsequent careers twenty years later (8). Will equally good or better predictions be obtained by use of the revised scale?

Scores on the original and revised scales correlate .85. In the revision of 28 other occupational scales, the average

correlation between the original and revised scales was .93. In only two of the 28 revisions did the correlations fall below .85, namely, .83 and .81. Revision of these 28 scales involved an increase in size of the criterion group, on the average, of 64 cases (from 200 to 264 cases) and in most cases involved a revision of the men-in-general group as the point of reference. Revision of the physician scale involved an increase in size of the criterion group of 123 cases (from 377 to 500 cases) but no change in point of reference. In terms of these factors one would not expect as low a correlation as .85 between the original and revised physician scales. There was one other factor which may have contributed appreciably to this low correlation. The original scale was based very largely on graduates of Stanford Medical School, whereas the revised scale is based on graduates of all the medical schools in the country.

One measure of the goodness of an interest scale is the ratio of raw mean score divided by the raw standard deviation. On this basis the revised scale is greatly superior to the original scale—the ratios being, respectively, 2.72 and 1.84. If these ratios are multiplied by 10 and subtracted from 50, the result is the raw zero score expressed in standard scores, i.e., 22.7 and 31.6. The chance score always approximates the raw zero score, being 21.7 for the revised scale and 29.2 for the original scale. From the standpoint of chance there is less likelihood of obtaining a high score on the revised scale than on the original scale. Both scales are about equally reliable (.873 and .886).

TABLE 28

CORRELATIONS OF THE REVISED AND ORIGINAL
PHYSICIANS SCALES WITH OTHER VOCATIONAL
INTEREST BLANK SCALES
(*N* = 285 Stanford Seniors)

Scale	Physician Scale (revised)	Physician Scale (original)
Psychologist (rev.)	.75	.58
Physician (original)	.85	—
Dentist	.83	.87
Carpenter	.34	.23
Personnel Manager	-.24	-.51
Office Worker	-.54	-.72
Occupational Level	-.27	.03
Masculinity—Femininity	.02	-.06
Osteopath	.80	.69
Internist A	.93	.81
Surgeon A	.95	.85
Pathologist A	.93	.79
Psychiatrist A	.79	.54

Correlations between scores on the original and revised Physician Scales with scores on several other scales are given in Table 28. The four medical specialist A scales¹ correlate substantially higher with the revised scale than with the original scale (average .90 and .75, respectively). Aside from this difference,

¹For definitions of A and BO type scales refer to Technical Note B.

the corresponding correlation coefficients differ relatively little.

It appears that the general relationships between the interests of physicians and other occupational groups as established by the original scale are maintained to a large extent by the revised scale. Since the revised scale is based on a more recent and representative sample of physicians than was the original scale, it is recommended that this revised Physician Scale be used in counseling college men.

2. Need for a Psychiatrist Scale in Addition to a Physician Scale

As measured by the Vocational Interest Blank, surgeons differ least of all in their interests from physicians in general, internists are second, pathologists third, and psychiatrists fourth (see Table 29). This relationship holds whether differences in mean scores or per cent of overlapping are considered, and holds also on both A and BO type scales.

The same relationships hold when correlations are considered between each of the four specialist A scales and the revised Physician Scale. The Surgeon Scale correlates .95 with the Physician Scale, the

TABLE 29
COMPARISONS OF MEDICAL SPECIALIST SCALES
(Based on Vocational Interest Blank Only)

Type of Scale	Scale	Groups Compared	Difference in Means	Per Cent Overlapping
A	Internist	I vs. <i>P</i> _{med}	9.0	67
	Surgeon	S vs. <i>P</i> _{med}	6.5	75
	Pathologist	Pa vs. <i>P</i> _{med}	11.85	60
	Psychiatrist	Ps vs. <i>P</i> _{med}	13.25	52
BO	Internist	I vs. <i>P</i> _{med}	14.9	48
	Surgeon	S vs. <i>P</i> _{med}	14.5	53
	Pathologist	Pa vs. <i>P</i> _{med}	17.6	43
	Psychiatrist	Ps vs. <i>P</i> _{med}	18.2	35

*P*_{med} = Physicians in general, *N* = 100.
I = Internists, *N* = 100.
S = Surgeons, *N* = 100.
Pa = Pathologists, *N* = 100.
Ps = Psychiatrists, *N* = 100.

TABLE 30
 ROTATED FACTOR LOADINGS OF VOCATIONAL INTEREST BLANK SCALES
 (Factors II and III rotated 51° clockwise around I)

Scale	Factors				L ²
	I	II	III	IV	
1. Psychologist (rev.)	.728	.560	.278	.126	.937
2. Physician (original)	.897	-.284	.224	-.244	.995
3. Dentist	.873	-.304	-.198	-.298	.982
4. Carpenter	.447	-.122	-.811	.228	.924
5. Personnel Manager	-.310	.793	.000	-.078	.732
6. Office Worker	-.595	.287	-.505	-.018	.691
7. Occupational Level	-.087	-.400	.815	-.070	.851
8. Masculinity-Femininity	.142	-.230	-.550	.188	.410
9. Osteopath	.741	.061	-.215	-.584	.940
10. Internist A	.925	.260	.199	-.076	.969
11. Surgeon A	.953	.109	.098	-.268	.991
12. Pathologist A	.972	.216	-.054	.159	.1019
13. Psychiatrist A	.708	.659	.127	-.221	.1000
14. Internist BO	.127	.506	.695	.190	.790
15. Surgeon BO	.187	.190	.374	-.157	.236
16. Pathologist BO	.754	.256	-.038	.420	.812
17. Psychiatrist BO	-.137	.879	.162	-.125	.835

Decimal points omitted.

Internist Scale .93, the Pathologist Scale .93, and the Psychiatrist Scale only .79.

Correlations of .93 to .95 do not express perfect agreement, but they give no warrant for supposing that better guidance of college men can be given through the use of Internist, Surgeon, and Pathologist Scales in addition to the use of the Physician Scale. The lower correlation of .79 between physicians and psychiatrists raises the question, Should college men be tested on both scales instead of on only the Physician Scale?

It appears that physicians and psychiatrists differ more than physicians and dentists (.83), and about the same as physicians and osteopaths (.80), physicians and artists (.79), and physicians and physicists (.78) (5). On this basis there is warrant for the use of a psychiatrist scale in addition to a physician scale. Evidence from factor analysis distinctly supports this conclusion.

In order to obtain a better conception of the interrelations between the A and BO scales, a factor analysis was made

based on the intercorrelations of scores on 17 scales. Included in the matrix were 7 occupational scales, the 4 medical specialist A type scales, the 4 medical specialist BO type scales, the Occupational Level Scale, and the Masculinity-Femininity Scale. The scores are based on the Vocational Interest Blank only.

Several rotations of factors were made leading to the conclusion that the factor loadings as shown in Table 30 would be most useful. In this table the original factor loadings of Factors II and III were rotated 51° clockwise around Factor I.

The first factor may be named "medical interest." The scales and loadings expressive of this interest are:

.972	Pathologist A
.953	Surgeon A
.925	Internist A
.897	Physician (old)
.873	Dentist
.754	Pathologist BO
.741	Osteopath
.728	Psychologist (rev.)

.708 Psychiatrist A
-.595 Office Worker

Psychiatrists have a lower loading than any other medical group, even slightly lower than osteopaths and psychologists on the A scales. They score lower than the other three specialist groups on the BO scales.

Theoretically, medical interest should be eliminated in the BO scales since similarities in interests between physicians in general and the four specialist groups are ignored in the weighting of items. This holds true as shown by the drop in average loading for Factor I from .862 on the A scales to .059 on the Internist, Surgeon, and Psychiatrist BO Scales. For some unknown reason, the Pathologist BO Scale has the high loading of .754 in Factor I.

The second factor may be named "interest in people." The scales and loadings expressive of this interest are:

.879 Psychiatrist BO

.793 Personnel Manager
.659 Psychiatrist A
.560 Psychologist (rev.)
.506 Internist BO

Psychiatrists score much higher than other medical groups on this factor, so that as far as this factor goes they are to be grouped with personnel men and psychologists rather than with medical men. No interpretation is made of Factors III and IV. It appears that psychiatrists have less "medical interests" and more "interest in people" than the other three medical specialists and physicians in general.

These results suggest that a Psychiatrist Scale, in addition to the Physicians Scale, might be useful in counseling college men. There are indications that the proportion of physicians doing psychiatric work is increasing substantially. It may be that a certain number of men should enter the medical schools whose Physician Scale scores are only fair but whose Psychiatrist Scale scores are high.

TECHNICAL NOTE E

DEVELOPMENT OF THE MEDICAL SPECIALISTS PREFERENCE BLANK

ONE of the first decisions made on this project was to develop a blank specifically for use by the medical profession. All possible types of items that could be conceived of for this type of blank were freely discussed among the members of the project. A substantial number of conferences was held with interested members of the medical profession, and the ideas of some physicians and psychologists were obtained by correspondence.

One early decision was to emphasize the use of the "forced-choice" type of item which does not permit of an "indifferent" response. It was believed that this type of item would be more effective than the "Like-Indifferent-Dislike" item in forcing fine discriminations among quite similar professional groups. Later research by Zuckerman did not support this belief (10).

Another decision was to assign primary responsibility for the development of items in different areas to each of the four graduate assistants working on the project. They were Robert E. Adamson, Ralph J. Garry, Milton G. Holmen, and John V. Zuckerman. The several types of items that were constructed will each be considered by indicating: (1) kind of item, (2) responsible assistant, (3) number of such items constructed, (4) brief statement of rationale, and (5) sample item.

1. Personal and Professional Relationships-Holmen-80 items. The several types of specialists would differ as to their expressed preferences regarding the characteristics of their professional associates. Sample item-Which characteristic do you consider more desirable in an as-

sociate? (A) Conducts office in very businesslike manner. (B) Conducts office in very friendly, informal manner.

2. Medical and Premedical School Subjects-Holmen-45 items. There would be stable differences among specialists as to liking or disliking certain subjects while in school. Sample item-Indicate whether you liked, were indifferent to, or disliked, Comparative Physiology, Cytology, etc.

3. Casual Acquaintances and Dinner Companions-Holmen-40 items. Specialists would tend to differ in preferring the company of individuals in different occupations. Sample items-On a cross-country train trip, would you like or dislike to make the acquaintance of a: Banker, Artist, Reporter, etc.? At a large dinner party, would you like or dislike to be seated beside a woman who was a: Club Leader, Tennis Professional, Librarian, etc.?

4. Magazines-Holmen-20 items. There would be differences in preferences for magazines. Sample item-Do you like each of the following magazines: *Life*, *Colliers*, *Reader's Digest*, etc.?

5. Amusements-Holmen-20 items. There would be differences in preferences for amusements. Sample item-Indicate which of each of the following pairs of amusements you prefer: Play Bridge or Play Poker; Western Movies or Whodunit Movies, etc.

6. Occupational Preferences-Zuckerman-90 items. It was postulated that there are four modes of dealing with the environment, namely, analytic, visual, social, and manipulative, which are measured by descriptions of occupational and avocational activities. It was believed that

the different medical specialists would prefer different modes of behavior. Sample item—Indicate which of each pair of occupational activities you would prefer: (A) Interpret spoken passages for individuals who speak only foreign languages. (B) Install aerials for radio receiving sets; set up poles and attach the wires to them.

7. Recreational Activities—Zuckerman—78 items. Essentially the same rationale as for the Occupational Preference items. Sample item—Indicate which of the activities you prefer: (A) Build a home-made radio set. (B) Look at a picture magazine.

8. Biographical Data—Adamson—86 items. It was believed that differences in background and early behavior would differentiate among the several types of specialists. Sample item—In grade school, did you (A) Get into many fights? (B) Avoid fights by trying to "talk it over"? (C) Fight only when forced to?

9. Type of Leadership—Garry—86 items. Three types of leadership were postulated which could be crudely labeled autocratic (leader-centered), democratic (group-centered), and laissez-faire (individual-centered). It was believed that surgeons would tend to prefer autocratic leadership, psychiatrists the democratic, and internists the laissez-faire. Sample item—Do you prefer the leader who: (A) Assumes that group members know routine procedures, or (B) Gives specific orders in routine tasks.

Experimental blanks containing these items were administered to approximately 300 Medical Corps officers at Letterman, Fitzsimons, and Brooke Army Hospitals. Included in this group were the interns, and the resident and staff doctors of the Medical, Surgical, Neuropsychiat-

ric, and Laboratory Services. Item counts were made of the responses of the various groups.

The best items of these experimental blanks were selected for use in Form C of the Medical Specialists Preference Blank, which included 194 items. In selecting items for this blank, consideration was given to the ability to differentiate among the several groups of Army Medical Corps Officers. However, the selection was not done on a strictly objective basis.

Form C of the Medical Specialists Preference Blank was used in the mailing to the large civilian groups of Internists, Surgeons, Pathologists, and Psychiatrists, and to the physicians-in-general group selected by the American Medical Association. Item counts on these groups were the basis for the development of the scales used in this research.

Form D represents a revision of this blank which retained all items that were weighted on the scales. The section on Types of Leadership was eliminated because of generally poor differentiation and because of the large number of items not answered. In order to facilitate scoring, the four- and five-choice Biographical Information items were restructured as three-choice items. This form contains 171 items in the following parts: Professional Associate—50 items; Biographical Data—24 items; Medical School Subjects—35 items; Traveling—15 items; Occupations—27 items; and Activities—20 items.

Form D was used in obtaining data on the following groups: medical school seniors, Army interns, Army Command and Staff medical officers, orthopedic surgeons, urologists, neurological surgeons, and pediatricians.

TECHNICAL NOTE F

CROSS VALIDATION AND RELIABILITY

THE true validity of the medical specialist scales, that is, their ability to predict future behavior, can only be determined by follow-up studies extending over a period of several years. Arrangements have been made for such studies by collecting blanks from approximately 750 medical school seniors.

In the meantime, any cross-validation data are of interest in estimating the probable shrinkage in effectiveness when administered to new groups. Unfortunately, most of the available criterion populations were used in establishing these scales. However, some blanks were received after the item counts were made and these blanks constitute one source of cross-validation data. These groups are small, ranging in size from 24 to 80.

Table 31 compares the distributions of scores on the blanks used in the item counts on which the scales were based with the scores on the blanks received later. No change is indicated on the Internist and Pathologist Scales and the changes on the other two scales are of doubtful significance. It appears that a few blanks in the 30-34 standard score range by the surgeons and psychiatrists may largely account for the changes in means on these scales.

Another method of examining the cross-validation groups is to determine the percentage of overlap of the various pairs of groups on the four medical-specialist scales. Table 32 presents the results of such an analysis. It is interesting that five out of the six comparisons in-

TABLE 31
DISTRIBUTIONS OF SCORES OF CRITERION GROUPS AND SMALL CROSS-VALIDATION GROUPS ON THE MEDICAL SPECIALIST SCALES

Standard Score	Per Cent of Internists on Internist Scale		Per Cent of Surgeons on Surgeon Scale		Per Cent of Pathologists on Pathologist Scale		Per Cent of Psychiatrists on Psychiatrist Scale	
	Item Count Blanks N=211*	Extra Blanks N=80	Item Count Blanks N=188*	Extra Blanks N=58	Item Count Blanks N=100*	Extra Blanks N=24	Item Count Blanks N=167*	Extra Blanks N=35
65+	7.1	6.2	7.4	5.2	6.0	8.3	6.6	5.7
60-64	10.0	8.8	9.6	5.2	10.0	8.3	11.4	2.9
55-59	14.7	20.0	17.0	10.3	16.0	29.2	18.0	14.4
50-54	17.1	18.8	21.3	20.7	21.0	12.5	22.2	22.8
45-49	19.8	13.8	21.3	22.4	15.0	4.3	15.6	22.8
40-44	18.5	16.2	14.3	15.5	16.0	20.8	11.4	11.4
35-39	8.5	8.8	5.3	5.2	10.0	8.3	9.6	5.7
30-34	1.9	1.2	2.7	13.8	4.0	8.3	1.8	8.6
29-	2.4	6.2	1.1	1.7	2.0	—	3.4	5.7
Total	100%	100%	100%	100%	100%	100%	100%	100%
Mean	49.70	49.40	50.85	47.15	49.55	50.35	50.40	47.55
SD	9.45	10.15	8.80	9.80	9.60	10.25	9.75	10.00
CR of Diff.		.29		2.57		-.35		1.54

* The item counts used in constructing the scales were based on samples of approximately 400, as shown in Table 6. The smaller number shown here represents the doctors who returned both the Vocational Interest Blank and the Medical Specialists Preference Blank.

TABLE 32
COMPARISONS OF THE OVERLAP OF CRITERION GROUPS AND SMALL CROSS-VALIDATION GROUPS
ON THE MEDICAL SPECIALIST SCALES

Scale	Groups Compared	Per Cent of Overlap	
		Criterion Groups	Cross-Validation Groups*
Internist	Internists vs. Surgeons	31	42
	Internists vs. Pathologists	61	58
	Internists vs. Psychiatrists	60	60
Surgeon	Surgeons vs. Internists	24	37
	Surgeons vs. Pathologists	31	48
	Surgeons vs. Psychiatrists	18	31
Pathologist	Pathologists vs. Internists	53	51
	Pathologists vs. Surgeons	44	46
	Pathologists vs. Psychiatrists	42	38
Psychiatrist	Psychiatrists vs. Internists	57	62
	Psychiatrists vs. Surgeons	38	51
	Psychiatrists vs. Pathologists	46	47
	Average	42%	48%

* Size of cross-validation groups—Internists $N = 80$, Surgeons $N = 58$, Pathologists $N = 24$, Psychiatrists $N = 35$.

TABLE 33
ESTIMATES OF THE RELIABILITY OF THE SCALES
(Correlations of Odd-Even Items)
 $N = 100$ Physicians in general

Scale	Type	Vocational Interest Blank			Medical Specialists Preference Blank			Both Blanks		
		Items	Raw	Corrected	Items	Raw	Corrected	Items	Raw	Corrected
Internist	BS	65	.47	.64	32	.39	.56	97	.52	.69
	BO	182	.62	.76	96	.70	.83	278	.75	.86
Surgeon	BS	87	.58	.73	51	.46	.63	138	.65	.78
	BO	184	.60	.75	85	.46	.63	269	.65	.79
Pathologist	BS	116	.67	.80	59	.55	.71	175	.67	.80
	BO	229	.72	.83	103	.47	.64	232	.74	.85
Psychiatrist	BS	165	.77	.87	71	.55	.71	236	.80	.89
	BO	250	.77	.87	110	.64	.78	360	.82	.90
Specialization Level	BO	149	.62	.77	71	.31	.47	220	.65	.79
Surg—Int	C	194	.65	.79	102	.67	.80	296	.77	.87
Path—Int	C	186	.70	.82	91	.49	.65	277	.69	.82
Psych—Int	C	230	.76	.86	102	.30	.34	332	.69	.82
Path—Surg	C	240	.68	.81	95	.56	.72	335	.73	.84
Psych—Surg	C	253	.77	.87	120	.68	.81	373	.85	.92
Psych—Path	C	252	.75	.86	121	.52	.69	373	.79	.88

Items = Number of items weighted on the scale.

Raw = Product moment correlation between score on odd versus even items.

Corrected = Raw corrected by Spearman-Brown formula.

volving surgeons show a marked increase in overlap while all the other comparisons show little difference between the criterion and cross-validation groups. In fact, the six comparisons which do not involve surgeons have the same average overlap in each group. It is not possible, at this time, to determine whether these results with the surgeons are an artifact due to a few peculiar blanks in the small cross-validation group or because the Surgeon Scale is less stable than the others.

The validity of scales, that is, how well the various scales differentiate between groups, has been emphasized in this research report. Another measure of the goodness of a scale is reliability. What is the reliability of the various scales?

One estimate of reliability is the correlation between scores on the odd-numbered items and scores on the even-numbered items on each scale. This type of reliability refers primarily to the internal consistency of the scale. Table 33 reports the raw odd-even correlations for each scale, as well as these correlations corrected by the Spearman-Brown formula. The number of items on each scale is also indicated.

The scales which are of primary interest are the Internist, Surgeon, Pathologist, and Psychiatrist BS scales. These four BS scales have an average reliability of .791 and contain, on the average, 162 items per scale. The corresponding BO scales have an average reliability of .850 and the average number of items per scale is 285.

Since there is a direct relationship, as based on our data, between reliability coefficients and number of items in the scales, the reduction in reliability from BO to BS scales is to be attributed to the decrease in number of items used in

BS scales as compared to BO scales. This is particularly true with respect to the BS Internist Scale.

Another measure of reliability, referred to as the coefficient of stability, is based upon the correlation between test and retest scores, where the two blanks are completed within a relatively short period of time. Burnham reported such coefficients for eight interest scales for an interval of one week (2). These eight coefficients averaged .906 in contrast to .866 for coefficients based on odd-even comparisons. It is likely that the coefficients of reliability given in Table 31 are lower than they would be if based on test-retest scores.

The size of a correlation coefficient is affected by the range of scores on which the computations are based. The coefficients in Table 33 are based on blanks from the physician-in-general group. It seemed appropriate to use this group since the BO and BS scales were designed to differentiate physicians. The physician-in-general group is, however, a relatively homogeneous group.

The issue is whether or not scales with poorer validity and better reliability should be preferred to scales with better validity and poorer reliability (see Tables 21 and 33). BS scales have been selected over BO scales on the basis of greater validity. It is believed that validity is more important than reliability, that validity automatically necessitates reliability, and that the measures of internal consistency in Table 33 are not complete measures of reliability.

The answer to the above question must wait until there can be a follow-up of medical students which will ascertain the extent to which scores of medical students on the two types of scales are related to subsequent medical careers.

APPENDIX I

CHARACTERISTICS OF SPECIALIST CRITERION GROUPS

A. Age In Years

Item		Intern- ists	Surgeons	Pathol- ogists	Psychi- atrists	Physi- cians in General
Mean Range		36.9 32-39	38.4 31-44	40.5 31-49	39.3 32-46	40.9 24-55

B. Per Cent Residing in Each Geographical Area*

	Of All Physi- cians in U.S.	Intern- ists	Surgeons	Pathol- ogists	Psychi- atrists	Physi- cians in General
1. New England	7.9	7.6	9.2	9.1	9.8	8.4
2. North Atlantic	29.6	26.8	26.0	31.7	39.9	30.4
3. Midwest	28.1	26.8	24.6	25.3	25.1	28.4
4. South	15.3	16.8	16.9	13.0	9.2	14.5
5. Southwest	5.8	6.2	6.1	4.4	3.3	5.4
6. Mountain	2.3	2.6	3.1	3.5	2.4	2.3
7. Pacific	11.0	13.2	14.1	13.0	10.3	10.6
Total	100%	100%	100%	100%	100%	100%

C. Per Cent Graduates of Medical Schools Located In Each Geographical Area*

Area		Intern- ists	Surgeons	Pathol- ogists	Psychi- atrists	Physi- cians in General
1. New England		10.7	15.5	10.8	10.5	8.0
2. North Atlantic		31.1	32.1	36.6	36.6	30.8
3. Midwest		35.1	30.6	32.4	37.1	35.2
4. South		13.1	11.7	9.5	7.1	17.0
5. Southwest		3.8	3.3	1.7	2.8	4.2
6. Mountain		1.0	.6	1.5	1.3	.8
7. Pacific		5.2	6.2	7.5	4.6	4.0
Total		100%	100%	100%	100%	100%

* New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut. North Atlantic: New York, Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia. Midwest: Ohio, Michigan, Indiana, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Kansas, Nebraska, Illinois. South: Virginia, West Virginia, Kentucky, Tennessee, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas, Louisiana. Southwest: Texas, Oklahoma, New Mexico, Arizona. Mountain: Idaho, Montana, Wyoming, Nevada, Utah, Colorado. Pacific: Washington, Oregon, California.

APPENDIX II*

REPORT OF MEDICAL INTERESTS

Purpose

The purpose of this report is to assist you in planning your career. It is based on your responses on the Vocational Interest Blank for Men¹ and the Medical Specialists Preference Blank.² The Vocational Interest Blank has been widely used for many years in assisting young men in making decisions regarding their vocational careers. The Medical Specialists Preference Blank has been developed specifically for use by the medical profession.

The extent to which your interests agree or disagree with those of successful men in certain types of work are indicated. Extensive research over the past twenty-five years shows that such measures have considerable accuracy in predicting whether one would like certain occupations or not. Continuing high motivation and job satisfaction appear to be related to these measures of common interests.

This is not a report of your aptitudes or abilities to do certain types of work. For example, questions regarding your ability to get through medical school or to learn to perform surgical operations are not answered by this report.

The measures of the interests of physicians and of the four major medical specialties have been developed by the Medical Specialists Research Project, Stanford University.³ The physician scale is based on the responses from a random sample of practicing M.D.'s selected by the American Medical Association in 1949 from their records. The specialists scales are based on the blanks of approximately 1800 diplomates of the American Boards of Internal Medicine, Surgery, Pathology, and Psychiatry and Neurology.

Explanation of Scores

Four questions confront anyone considering medicine as a career. First, should one be a physician or engage in some other occupation? Second, if a physician, should one specialize in one of the 32 recognized specialties to the extent of taking several years residency training and passing the board examinations? Third, if one is to specialize, which specialty should one select? And fourth, what types of activities within the medical profession would one like to do?

Test No. 1 answers the first question. Your interests are compared with the interests of the average doctor and the score indicates whether your interests are more in agreement with the interests of the average doctor or more in agreement with the average man engaged in those occupations which college men expect to enter. Table 1 gives the percentages of various groups who have ratings from A to C on the physician scale. If you have a B rating, for example, in physician interest it means that at least 84 percent of physicians have interests more akin to the average doctor than you do and at least 8 percent of physicians have interests less akin to the average doctor, than you do. Having a B— or C rating does not mean you cannot be a doctor, but that you probably will not enjoy treating patients and that there may be some other occupational activity which is more akin to your interests.

¹ Vocational Interest Blank for Men (revised) Form M by Edward K. Strong, Jr., Stanford University.

² Medical Specialists Preference Blank, Form D (Research edition), by E. K. Strong, Jr., A. C. Tucker, R. E. Adamson, M. G. Holmen, J. V. Zuckerman, Stanford University.

³ Contract No. W-49-007-MD-483 with the Surgeon General, U.S. Army.

TABLE 1. RATINGS ON THE PHYSICIAN INTEREST SCALE

Rating	Percent of Practicing Physicians	Percent of Seniors in Medical School	Percent of Non-Medical College Students	Percent of Graduate Students in Business Administration
A	71	73	11	1
B+	13	14	10	2
B	8	8	13	4
B—	5	4	13	10
C	3	1	53	83
Total	100%	100%	100%	100%

* This is a reproduction of the form used in reporting medical interest scores.

The second question is answered by Test No. 2, i.e., do you have the interests of medical specialists or the interests of the average non-specialist doctor? About fifteen percent of physicians are today diplomates in some specialty. It is probable that this percentage will be doubled in the next twenty years. You may or may not wish to go through the long specialized training perfecting yourself in a particular specialty and may or may not desire to limit your practice as is required of a diplomate.

The third question is partially answered by the four Tests 3, 4, 5 and 6. At the present time tests are available for only the four specialties of Internist, Surgeon, Pathologist, and Psychiatrist. How you score on these four specialties may also give some idea of how you might score on other specialties which are akin to these four. For example, the surgeon's score should represent the areas of urology and orthopedic surgery quite well. Similarly cardiology and dermatology appear closely related to internal medicine.

A high score on one of the specialties coupled with a low score on Test 2 suggests that you will enjoy work in that activity but that you may not want to spend several years in rigorous preparation or to devote all your time to it.

The four Tests 3, 4, 5 and 6 apply only to men who have the interests of doctors. These scores are meaningless if you rate C or B- on the physician scale and questionable if you have a B rating.

Some men score about equally high on two, or even three, of the four specialties. In such cases information is given in No. 7 as to whether there is a real difference (yes), a probable difference, or the scores are tied.

The fourth question refers to types of work within

the medical profession which will be interesting to you. The scores for the ten occupational scales listed in No. 8 may be helpful. Among graduates of medical schools some devote relatively little or no time to the treatment of patients, spending their time in a variety of activities, such as teaching, research, hospital administration, preventive medicine, marketing medical supplies, etc.

Your scores in No. 8 may be interpreted in two ways. First, with reference to how men score who are engaged in these occupations. An A rating means "yes," you have the interests of men in that occupation. A rating of B+ means "probably," etc. Such ratings are interpreted in the same way as your score in physician interest in No. 1.

For some purposes it is well to consider how your interests compare, not with men engaged in the ten occupations, but with doctors alone. The shaded areas provide the basis for such interpretations of your scores. Twenty-five percent of physicians score above the shaded area, fifty percent score within the shaded area, and twenty-five percent below this area. For example, if your score on office worker is a B, it means you possibly have the interests of office workers; but you have more of the interests of office workers than the great majority of physicians. Such a score suggests that you may like administrative work, or at least dislike it less than most doctors. Bear in mind that all administrators spend much of their time handling letters and report forms, the work of an office man.

Similarly, a high score on chemist may suggest research in medicine involving chemistry. A high score on the public administrator scale might indicate work in a public medical activity in contrast to private practice. A high score on the life insurance salesman scale, not at all common among doctors, might suggest some sales activity related to medicine.

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Stanford University, California
January 1952

REPORT OF MEDICAL INTERESTS

NAME DATE

ADDRESS

Your interests are similar to those of:

[illegible]

7. Where two or more specialists interests scores are about equal, your interests are more similar to (a) than to (b) as follows:

4-	5 to 9	10+
Tied	Probably	Yes

a. b.

8. Your Vocational Interest Blank has been scored on other scales and this supplementary information may be helpful to you.

	C	B—	B	B+	A
a. Administrative Interests					
Public Administrator					
Office Worker					
Personnel Manager					
b. Teaching and Research Interests					
Math-Science Teacher					
Psychologist					
Chemist					
c. Persuasive Interests					
Life Insurance Salesman					
d. Linguistic Interests					
Author-Journalist					
e. Aviation Interests					
Aviator					

- ### 9. Comments.

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